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No. ——

IN THE

Supreme Court of the United States

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.,
Petitioner,

v.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
AND SAMSUNG SEMICONDUCTOR, INC.,
Respondents.

Petition For Writ Of Certiorari to the United States Court of Appeals for the Federal Circuit

APPENDIX TO PETITION FOR WRIT OF CERTIORARI

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APPENDIX A
(Federal Circuit Decision)

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

98-1377, 99-1103

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.,
Plaintiff-Appellant,

v.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS CO. AMERICA, INC.
AND SAMSUNG SEMICONDUCTOR, INC.,
Defendants-Cross Appellants.

J. ALAN GALBRAITH, Williams & Connolly, of Washington, DC; and JOEL DAVIDOW, Ablondi, Foster, Sobin & Davidow, P.C., of Washington, DC, argued for plaintiff-appellant. With them on the brief was DAVID S. BLATT, Williams & Connolly. Of counsel was MICHAEL T. BRADY, Ablondi, Foster, Sobin & Davidow. P.C

DAVID J. HEALEY, Tobor, Goldstein & Healey L.L.P., of Houston, Texas, argued for Defendants-cross appellants. With him on the brief was GARY J. FISCHMAN. of counsel on the brief were RICHARD L. STANLEY, Arnold White & Durkee, of Houston, Texas; and CECILIA H. GONZALEZ, Howrey & Simon, of Washington. DC. Of counsel was BASIL CARL CULVBA, Howrey & Simon.

Appealed from: United States District Court for the Eastern District of Virginia

Judge Thomas Selby Ellis III

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

98-1377, 99-1103

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.,
Plaintiff-Appellant,

v.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.
AND SAMSUNG SEMICONDUCTOR, INC.,
Defendants-Cross Appellants.

DECIDED:March 2, 2000

Before MICHEL, *Circuit Judge*, SKELTON, *Senior Circuit Judge*, and SCHALL, *Circuit Judge*.

[2] MICHEL, *Circuit Judge*.

On October 10, 1996, Semiconductor Energy Laboratory Co., Ltd. ("SEL") sued Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., and Samsung Semiconductor, Inc. (collectively "Samsung") in the United States District Court for the Eastern District of Virginia, alleging that Samsung's production and sales of active matrix displays infringed SEL's U.S. Patent No. 5,543,636 ("the '636 patent") directed to semiconductor technology. The district court first granted SEL's motion for summary judgment dismissing Samsung's federal and New Jersey Racketeer Influenced and [3] Corrupt Organizations ("RICO") counterclaims. *See SEL v. Samsung*, 4 F. Supp. 2d 473 (E.D. Va. 1998) ("*SEL I*"). After a seven-day bench trial, the district court also held the '636 patent to be unenforceable

for SEL'S inequitable conduct before the Patent and Trademark Office ("PTO"). *See SEL v. Samsung*, 4 F. Supp. 2d 477-(E.D. Va. 1998) *("SEL 2"); SEL v. Samsung*, 24 F. Supp. 2d 537 (ED. Va. 1998) ("SEL 3"). Both parties appeal. Because we are not persuaded that the district court either abused its discretion in holding the '636 patent unenforceable for inequitable conduct or improperly dismissed Samsung's federal and New Jersey RICO counterclaims. we *affirm*.

BACKGROUND

SEL is a Japanese company specializing in the research and development of semiconductor technology. SEL engages in no manufacturing and supports its research efforts from revenues from patent licensing. Since 1980, SEL has filed over 5,000 patent applications worldwide and has been awarded approximately 1,500 U.S. and foreign patents. Dr. Shunpei Yamazaki, a solid state physicist and the president and majority shareholder of SEL, is the named inventor or co-inventor on most of SEL's patents, including the '636 patent.

Entitled "Insulated Gate Field Effect Transistor" ("IGFET"), the '636 patent claims a non-single crystal silicon thin film transistor ("TFT"), a type of IGFET. Such TFTs can be used to switch the pixels in an active matrix display unit on or off. The TFT includes a source, a drain, a silicon nitride gate insulator, an insulated substrate, and an intrinsic amorphous silicon channel region. The channel region is "sandwiched" between the gate insulator and the insulated substrate. By limiting the level of oxygen, carbon, or nitrogen in the channel region to an amount not exceeding 5×10^{18} atoms/cm^3, the [4] claimed invention greatly improves the TFT's electrical properties and consequently overcomes potential deficiencies, such as hysteresis (blurring).

The application for the '636 patent was filed on June 7, 1995, and the '636 patent itself issued on August 6, 1996;

SEL alleges a much earlier priority date of May 18, 1984, however. Gerard Ferguson, SEL's patent attorney, prosecuted the application for the '636 patent and its ancestor applications, except for a brief period when Dr. Yamazaki revoked his power of attorney because Mr. Ferguson sought to submit certain material prior art references to the PTO.

The '636 patent began as a former 37 C.F.R. § 1.60 (1995) ("Rule 60") divisional application, and thus had its own Information Disclosure Statement ("IDS") [1] The IDS, filed on November 15, 1995, was fifteen pages long. The IDS was accompanied by a Form PTO-1449 listing ninety references that it wished to make of record, each of which the examiner initialed. These references included Japanese Laid-Open Application No. 56-135968, assigned to Canon K.K. ("the Canon reference"). In the IDS, SEL submitted the entire 29-page Canon reference in its original Japanese, a concise explanation of its relevance, and an existing one-page partial English translation from a prior unrelated patent application. The concise explanation succinctly described the Canon reference as disclosing "the use of silicon nitride for a gate insulating layer of a thin film transistor." The one-page partial translation covered four short sections of the Canon reference describing a TFT structure, a semiconductor layer consisting of [5] amorphous silicon, a gate electrode coated with silicon nitride, and an empirical observation of the effect of substituting silicon oxide for silicon nitride. SEL also made of record three references that a potential licensee, IBM, had brought to its attention as important prior art for obviousness purposes: a 1983 article by C.C. Tsai, entitled "Amorphous Si Prepared in a UHV Plasma Deposition System" ("the Tsai

---

[1] Under former Rule 60, a divisional application included a copy of the previous application, but did not include the previous file wrapper. By contrast, a 37 C.F.R. § 1.62 (1995) ("Rule 62") continuation application required the application to "utilize the file wrapper and contents of the prior application." 37 C.F.R. § 1.62(e).

article"), and two of Dr. Yamazaki's solar cell patents, Japanese Patent Laid-Open Application Nos. 59-35423 ("the '423 application") and 59-35488 ("the '488 application"). The Tsai article and the '423 and '488 applications all teach the reduction of impurities below the level claimed in the '636 patent.

On October 10, 1996, SEL filed a complaint in the United States District Court for the Eastern District of Virginia alleging that Samsung's active matrix displays and computers having such displays infringed three of SEL's semiconductor patents: the '636 patent, U.S. Patent No. 5,521,400 ("the '400 patent"), and U.S. Patent No. 5,349,204 ("the '204 patent").[2] Samsung denied infringement and asserted numerous affirmative defenses, including non-enablement, obviousness, best mode violation, and inequitable conduct. Samsung subsequently counterclaimed, charging SEL with federal and New Jersey RICO, antitrust, and unfair competition violations.

SEL moved for summary judgment on Samsung's inequitable conduct defense and on Samsung's RICO, antitrust, and unfair competition counterclaims. The district court granted SEL's motion on the RICO and antitrust counterclaims, but denied it on the inequitable conduct defense and the unfair competition counterclaim.

[6] After a seven-day bench trial, the district court found the '636 patent to be unenforceable for inequitable conduct under two alternative theories. First, the district court determined that, by submitting a concise explanation and a one-page partial translation of the Canon reference that were accurate but misleadingly incomplete, SEL had intentionally withheld the Canon reference from the PTO. *See SEL 2*, 4 F. Supp. 2d

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[2] On March 4, 1998, SEL by stipulation amended its complaint to remove its allegations that Samsung was infringing the '400 and '204 patents. leaving the '636 patent the only patent-in-suit.

at 484. The concise statement, for example, identified only the silicon nitride gate as pertinent, and neglected to discuss the Canon reference's admonition to avoid impurities. Second, the district court determined that, by mischaracterizing the Tsai article as applying primarily to solar cells rather than TFTs in arguments to the PTO. SEL had intentionally misled the examiner into believing that the Tsai article was not material. *See id.* at 486.

The district court cited multiple facts as demonstrating SEL's deceitful intent. For example, Dr. Yamazaki could not satisfactorily account for his misstatement of the level of impurities discussed in U.S. Patent No. 4,766,477 to Nakagawa ("the Nakagawa reference") during the prosecution of U.S. Patent No. 5, 315, 132 ("the '132 patent"), which issued on an ancestor application to that of the '636 patent.[3] The district court similarly discredited Dr. Yamazaki's claim that he did not comprehend the significance of the Tsai article, since he had described a speech by Dr. Tsai discussing her work as "spectacular," had requested the article from Dr. Tsai in October 1983, and had cited it [7] in a 1984 article in the Journal of Non-Crystalline Solids. Moreover, Dr. Yamazaki's own '423 and '488 applications had expressly stated that the benefits of the low levels of impurities in solar cells also applied to TFTs. Though Dr. Yamazaki had submitted the Tsai article and his '423 and '488 applications to the PTO during the prosecution of the application for the '636 patent and the '455 application, the district court noted that he did so only after IBM, a potential licensee, expressly called its attention to these

---

[3] *SEL 2* provides a genealogy chart clarifying the relationships between the '132 patent, the '636 patent, and interim applications. *See* 4 F. Supp. 2d at 497. In short, the '636 patent resulted from a divisional application of U.S. Patent Application No. 425,455 ("the '455 application"), which in turn was a continuation of U.S. Patent Application No. 214,494 ("the '494 application"), which in turn was a divisional application of the application which resulted in the '132 patent.

references. Thus, the district court concluded that "[t]he evidence demonstrate[d] a sophisticated, subtle, and consistent effort to hide the ball from the PTO in a manner plainly at odds with an applicant's duty of candor, good faith, and honesty." *SEL 2*. 4 F. Supp. 2d at 496.

In response to SEL's motion to reconsider *SEL 2*, the district court issued a new opinion correcting its previous discussion of the Tsai article. See *SEL 3*, 24 F. Supp. 2d at 537. The district court recognized that SEL's misrepresentations with respect to the Tsai reference had actually occurred during SEL's prosecution of the '455 and '494 applications, the two applications immediately preceding the application that resulted in the '636 patent, and were not repeated during the prosecution of the application that resulted in the '636 patent. Relying upon a doctrine of "infectious unenforceability" discussed, but not applied, in *SEL 2*, 4 F. Supp. 2d at 493, however, the district court held that SEL's misrepresentations during the prosecution of the ancestor '455 and '494 applications provided an alternative basis for rendering the '636 patent unenforceable. *See SEL 3*, 24 F. Supp. 2d at 545.

[8] DISCUSSION

I. Inequitable Conduct

Patent applicants are required to prosecute patent applications with candor, good faith, and honesty. *See Molins PLC v. Textron, Inc.*, 48 F.3d 1172, 1178, 33 USPQ2d 1823, 1826 (Fed. Cir. 1995). "[I]nequitable conduct includes affirmative misrepresentation of a material fact, failure to disclose material information, or submission of false material information, coupled with an intent to deceive." *id.* The alleged infringer, whether a defendant in a patent infringement suit or a declaratory judgment plaintiff must demonstrate by clear and convincing evidence both that the

information was material and that the conduct was intended to deceive. *See id.*

The court first discerns whether the withheld references or misrepresentations satisfy a threshold level of materiality and whether the applicant's conduct satisfies a threshold showing of intent to deceive. *See id.* If these thresholds are satisfied, the trial court balances materiality and intent to determine whether the equities warrant the conclusion that inequitable conduct occurred. *See id.* at 1178, 33 USPQ2d at 1827. "In light of all circumstances, an equitable judgment must be made concerning whether the applicant's conduct is so culpable that the patent should not be enforced. " *id.*

We may reverse a determination of inequitable conduct only if it is based on "clearly erroneous findings of fact or on a misapplication or misinterpretation of applicable law, or evidences a clear error of judgment on the part of the district court." *Id.* We review the district court's subsidiary determinations of materiality and intent for clear error, and may disturb them only if we are left with "a definite and firm conviction" [9] that the district court committed a mistake. *Id.* We review a district court's ultimate determination of inequitable conduct under an abuse of discretion standard. *See id.*

A. Materiality

37 C.F.R. § 1.56 (1995) ("Rule 56") defines information as material to patentability when:

> [I]t is not cumulative to information already of record or being made of record in the application, and
>
> (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
>
> (2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentabiiity relied on by the Office, or

(ii) Asserting an argument of patentability.

A withheld reference may be highly material when it discloses a more complete combination of relevant features, even if those features are before the patent examiner in other references. *Molins*, 48 F.3d at 1180, 33 USPQ2d at 1828.

Reiterating many of its arguments before the district court, SEL contends that the untranslated portions of the Canon reference were not material to patentability because they were cumulative to other information. More particularly, SEL alleges that the Canon reference, only discloses a conventional IGFET device and generally teaches the avoidance of impurities on the surface of the intrinsic semiconductor layer. SEL also contends that the Canon reference, whether alone or combined with other references. would not have established a prima facie case of unpatentability, since it does not disclose the maximum impurity level of oxygen, nitrogen, or carbon in the channel region for overcoming the hysteresis problem.

[10] We discern no clear error in the district court's finding that the Canon reference was material. The district court cited several reasons for finding the Canon reference to be material to patentability. First, the district court found that the Canon reference was not cumulative, since the untranslated portions of Canon contained a more complete combination of the elements claimed in the '636 patent than anything else before the PTO. Specifically, the Canon reference discloses the intrinsic amorphous silicon layer, the silicon nitride gate insulator, the sandwich structure, and the key admonition to avoid impurities in semiconductor materials, each of which is claimed by the '636 patent. Second, the district court found that the Canon reference established a prima facie case of unpatentability in combination with other information, particularly the teachings of the Tsai article or Dr.

Yamazaki's own '423 or '488 applications. As Samsung's expert, Dr. Fonash, explained, a fully translated Canon reference would have provided a "good blueprint" for making the exact device described by the '636 patent. Consequently, taken together with the Tsai article, the Canon reference would have rendered obvious the asserted claims of the '636 patent.

B. Intent

"Intent need not be proven by direct evidence; it is most often proven by a showing of acts, the natural consequence of which are presumably intended by the actor." *Molins*, 48 F.3d at 1180. 33 USPQ2d at 1828-29. Generally, intent must be inferred from the facts and circumstances surrounding the applicant's conduct. *id.* at 1180-81, 33 USPQ2d at 1829. "Since the fact-finder has personally heard and observed the demeanor of witnesses, we accord deference to the fact-finder's assessment of a witness's credibility and character." ki. at 1131 , 33 USPQ2d at 1829.

[11] Proof of high materiality and that the applicant knew or should have known of that materiality makes it difficult to show good faith to overcome an inference of intent to mislead. *See Critikon. Inc. v. Becton Dickinson Vascular Access, Inc.*. 120 F.3d 1253, 1257, 43 USPQ2d 1666, 1669 (Fed. CIr. 1997). "The more material the omission or the misrepresentation, the lower the level of intent required to establish inequitable conduct, and vice versa." id. at 1256. 43 USPQ2d at 1668. In evaluating whether the district court clearly erred in its factual finding of deceitful intent, we must assure ourselves that the district court did not overlook mitigating factors. See *Akron Polymer Container Corp. v. Exxel Container, Inc.*, 148 F.3d 1380, 1384, 47 USPQ2d 1533, 1536 (Fed. Cir. 1998).

Again reiterating its arguments to the district court, SEL argues that it did not intend to mislead the examiner by

submitting only a partial translation of the Canon reference and a concise statement not addressing its key teachings, such as its admonition to avoid impurities. SEL contends that Dr. Yamazaki subjectively believed that the Canon reference was valuable only for its disclosure of the conventional IGFET structure.

As evidence of its good faith, SEL emphasizes that it submitted the entire Canon reference in its original Japanese. SEL also underscores the fact that it meticulously complied with 37 C.F.R. § 1.98(a),(c)[4] (1995) by providing an accurate, concise [12] explanation of the relevance of the Canon reference and a pre-existing partial translation. SEL further claims that Manual of Patent Examining Procedure ("MPEP") § 609 establishes "permissive," "non-burdensome," "free of risk," and "gently suggestive at best, and certainly not mandatory" standards for foreign language references. For example, SEL notes that MPEP § 609 does not require that the applicant discuss differences between the cited information and the claims. See MPEP § 609A(3); see also

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[4] 4 Rule 98 ("Content of information disclosure statement") provides in pertinent part:

> (a) Any information disclosure statement filed under § 1.97 shall include:
>
> (3) A concise explanation of the relevance, as it is *presently understood* by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein.
>
> (c) . . . if a written English-language translation of a non-English document, *or portion thereof*, is *within the possession*, custody, or control of, or is readily available to any individual designated in § 1.56(c), a copy of the translation shall accompany the statement.
>
> (emphasis added.)

Duty of Disclosure, 57 Fed. Reg. 2021, 2026, cmts. 24 & 26 (1992) (stating that Rule 56 does not require that applicant combine references against its own claims or analyze references.). According to SEL, its technical compliance with the FTO Rules should weigh against an inference of intent to deceive the examiner. *Cf Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 939, 15 USPQ2d 1321, 1327 (Fed. Cir.. 1990) (holding that amendment made as of right under MPEP weighs against an inference of intent to deceive). As further proof of its good faith, SEL highlights the fact that it voluntarily provided the Canon reference to the PTO without any prodding from a licensee (e.g., IBM).

[13] We discern no clear error in the district court's finding that SEL willfully misrepresented the Canon reference. As a general matter, we first note that the district court found Dr. Yamazaki and SEL's other witnesses to be not credible. Instead, the district court credited the testimony of Samsung's witnesses over that of SEL's whenever there was a conflict. The district court further found that Dr. Yamazaki, a solid state physicist whose native language is Japanese, understood the materiality of the Canon reference. The district court also determined that Dr. Yamazaki knew that a more complete translation or concise explanation of the relevance of the Canon reference would decrease the likelihood of the '636 patent being issued, given his understanding of the Canon reference and his immense experience in prosecuting patents. The district court thus concluded that Dr. Yamazaki must have consciously decided which sections to reveal to the PTO through SEL's partial translation.

Though SEL repeatedly highlights those actions that are not improper, SEL cannot overcome a finding of deceitful intent merely by showing that it did certain things properly. Rather, SEL must explain its conduct in failing to provide a more complete translation or concise explanation of the Canon reference. This it simply does not do. As the district

court noted, "the record as a whole reflects a clear pattern and practice of initial disclosure, followed by incremental disclosure only when compelled by the circumstances to do so, followed, at times, by mischaracterization." *SEL 2*, 4 F. Supp. 2d at 496.

SEL's technical compliance with Rule 98 and its entreaty to MPEP § 609A(3) lend it little aid. Though Rule 98 requires that the applicant provide any existing translation of a foreign reference, Rule 98 provides neither a safe harbor nor a shield [14] against allegations of inequitable conduct. As the district court explained, Rule 98 merely "provides a floor for required submissions of translations of foreign applications, not a ceiling; it is by no means an excuse or license for concealing material portions of a prior art reference." *SEL 3*, 24 F. Supp. 2d at 541. The district court found that Dr. Yamazaki knew that the Canon reference disclosed the important admonition to avoid impurities and that the preexisting, one-page partial translation did not discuss this teaching. Given the critical absence of this teaching from the partial translation and his knowledge of this absence, "[i]t was incumbent upon [Dr. Yamazaki] to provide the PTO with sufficient information for a reasonable examiner to consider the [submission] in context, not with a selective and misleading disclosure. The inventor[] failed to do that and cannot post facto hide behind the MPEP guidelines to argue that what [he] did with a purpose should be disregarded." *Refac Int'l, Ltd. v. Lotus Dev. Corp.*, 81 F.3d 1576, 1584, 38 USPQ2d 1665, 1672 (Fed. Cir. 1996).

Similarly, MPEP § 609A(3) merely indicates that "[t]he concise explanation may indicate that a particular figure or paragraph of the patent or publication is relevant to the claimed invention. It might be a simple statement pointing to similarities between the item of information and the claimed invention." Thus, though MPEP § 609A(3) allows the applicant some discretion in the manner in which it phrases

its concise explanation, it nowhere authorizes the applicant to intentionally omit altogether key teachings of the reference. If, as SEL suggests, the concise statement requirement allowed applicants to selectively disclose what they know as long as what they selected for disclosure was accurate, applicants could easily mislead the examiner by explaining all but one of the relevant elements, thereby leaving the examiner with the impression [15] that the reference did not anticipate, render obvious, or otherwise make unpatentable the claimed invention.

C. Failure to Disclose

Finally, SEL contends that, because it submitted the entire untranslated Canon reference to the PTO, it cannot be deemed to have withheld the reference from the examiner. *See Scripps Clinic & Research Found. v. Genentech, Inc.*, 927 F.2d 1565, 1582, 18 USPQ2d 1001, 1015 (Fed. Cir. 1991) ("When a reference was before the examiner. . . , it can not be deemed to have been withheld from the examiner."). SEL notes that the PTO does not require applicants to translate foreign references into English. *See MPEP* § 609C(2) ("The examiner should not require that a translation be filed by the applicant."). SEL thus claims that it cannot be faulted for not providing a more complete translation of the Canon reference.

SEL argues that the examiner, who is presumed to have done his job correctly, must also be presumed to have read and understood the Canon reference in its native Japanese. *See Molins*, 48 F.3d at 1184, 33 USPQ2d at 1832 (absent proof to the contrary, court assumed that examiner had considered a post-issuance, English-language submission under 37 C.F.R. § 1.501 that the examiner had initialed). SEL emphasizes that the PTO maintains a staff of translators and that an examiner "may request translations throughout the

examination process. "*Gambro Lundia AB v. Baxter Healthcare Corp.*, 110 F.3d 1573, 1582, 42 USPQ2d 1378. 1386 (Fed. Cir. 1997).

We perceive no clear error in the district court's conclusion that SEL effectively failed to disclose the Canon reference to the PTO by providing a one-page, partial translation of the entire 29-page application. By submitting the entire untranslated [16] Canon reference to the PTO along with a one-page, partial translation focusing on less material portions and a concise statement directed to these less material portions, SEL left the examiner with the impression that the examiner did not need to conduct any further translation or investigation. Thus, SEL deliberately deceived the examiner into thinking that the Canon reference was less relevant than it really was, and constructively withheld the reference from the PTO. SEL's submission hardly satisfies the duty of candor required of every applicant before the PTO.

SEL's contention that the examiner must have both read and fully understood the entire untranslated Canon reference based on his having read the misleadingly incomplete one-page translation and concise statement is absurd. Though the examiner is indeed presumed to have done his job correctly, there is no support in the law for a presumption that the examiner will understand foreign languages such as Japanese or will request a costly complete translation of every submitted foreign language document, particularly in the absence of any reason to do so. Rather, as MPEP § 609C(2) reveals, the examiner's understanding of a foreign reference is generally limited to that which he or she can glean from the applicant's concise statement:

> Information which complies with requirements as discussed in this section but which is in a non-English language will be considered *in view of the concise explanation submitted* (A (3) above) *and insofar as it is*

> *understood on its face; e.g. drawings, chemical formulas*, in the same manner that non-English language information in Office search files is considered by examiners in conducting searches. *The examiner need not have the information translated unless it appears necessary to do so.* The examiner will indicate that the non-English language information has been considered in the same manner as consideration is indicated for information submitted in English. The examiner should not require that a translation be filed by applicant. *The examiner should not make any* [17] *comment such as that the non-English language information has been considered to the extent understood since this fact is inherent.*

(emphasis added). Consequently, while the examiner's initials require that we presume that he or she considered the Canon reference, this presumption extends only to the examiner's consideration of the brief translated portion and the concise statement.

SEL's contention that the PTO should not require applicants to translate all foreign references into English misses the critical point. The duty at issue in this case is the duty of candor, not a duty of translation. The duty of candor does not require that the applicant translate every foreign reference, but only that the applicant refrain from submitting partial translations and concise explanations that it knows will misdirect the examiner's attention from the reference's relevant teaching. Here, the desirability of the examiner securing a full translation was masked by the affirmatively misleading concise statement and one-page translation.

Thus, we discern no clear error in the district court's findings with respect to materiality and intent, and hold that the district court did not abuse its discretion in finding the '636 patent to be unenforceable for SEL's inequitable conduct in providing a misleadingly incomplete, partial translation of

the Canon reference and a narrow and incomplete concise statement. Given our holding that the '636 patent is unenforceable in light of SEL's inequitable conduct with respect to the Canon reference, we expressly decline to reach the district court's alternative determination of "infectious unenforceability" based on SEL's misconduct during the prosecution of the '455 and '494 applications.

II. Federal and New Jersey RICO Counterclaims

Samsung cross-appeals the district court's grant of summary judgment dismissing its federal and New Jersey RICO counterclaims. We review a grant of summary judgment without deference, reapplying the same legal standard as the district court to the same record before it and drawing all reasonable inferences in favor of the non-moving party, here Samsung. See *Ford Motor Co. v. United States*, 157 F.3d 849, 854 (Fed. Cir. 1998).

A. Federal RICO

The asserted sections of the federal RICO statute provide:

> (a) It shall be unlawful for any person who has received any income derived, directly or indirectly, from a pattern of racketeering activity . . . to use or invest, directly or indirectly, any part of such income, or the proceeds of such income, in acquisition of any interest in, or the establishment or operation of, any enterprise which is engaged in, or the activities of which affect, interstate or foreign commerce.
>
> . . .
>
> (c) It shall be unlawful for any person employed by or associated with any enterprise engaged in, or the activities of which affect, interstate or foreign commerce, to conduct or participate, directly or indirectly, in the conduct of such enterprise's affairs

> through a pattern of racketeering activity or collection of unlawful debt.

18 U.S.C. § 1962. Section 1962(a) makes it illegal to *invest* the income of racketeering activity. Section 1962(c), by contrast, makes it illegal to *engage* in racketeering activity. Section 1964(c) provides a person with a civil remedy for injuries to business or property from violations of Section 1962.

A RICO plaintiff must demonstrate a "pattern of racketeering activity" consisting of at least two instances of racketeering activity. 18 U.S.C. § 1961(5); *Mylan Labs. Inc.* [19] *v. Matkari*, 7 F.3d 1130, 1135 (4th Cir. I 993). Mail and wire fraud both qualify as predicate acts under the federal RICO statute. See 18 U.S.C. § 1961(1) The mail fraud statute makes illegal the use of U.S. mail for "any scheme or artifice to *defraud*, or for obtaining money or *property* by means of false pretenses." 18 U.S.C. § 1341 (emphasis added). Similarly, the wire fraud statute makes illegal the use of "wire, radio, or television communication" for "any scheme or artifice to defraud, or for obtaining money or property by means of false or fraudulent pretenses, representations, or promises." 18 U.S.C. § 1343.

Samsung alleges a "three-party pass-through fraud structure" wherein SEL committed numerous acts of mail and/or wire fraud on the PTO. Samsung first claims that, long before the '636 patent issued, SEL targeted Samsung as a defendant for a patent infringement suit Samsung alleges that a competitor of Samsung, a "VIP" client of SEL, then agreed to pay SEL's litigation costs in its suit against Samsung. According to Samsung, SEL made material misrepresentations to the PTO using the U.S. mail and withheld material references from the PTO. Samsung claims that this fraud resulted in the improper issuance of the three originally asserted patents, which SEL in turn has employed to extort Samsung and others. Although Samsung concedes that the

direct fraud was perpetrated upon the PTO, Samsung asserts that it was the indirect but intended victim of this scheme. As a result of this litigation, Samsung claims to have spent millions of dollars on legal fees and design-around efforts and to have sustained injury to its relationships with its customers, who sought assurances that Samsung will indemnify them against potential patent infringement liability claims brought by SEL.

[20] The district court cited *Mylan Labs., Inc. v. Akzo. N.V.*, 770 F. Supp. 1053, 1071-73 (D. Md. 1991), *affd sub nom. Mylan Labs., Inc. v. Matkani*, 7 F.3d 1130 (4th Cir. 1993), as foreclosing inequitable conduct during patent prosecution from qualifying as a required predicate act. In *Akzo*, the RICO plaintiff alleged that the defendants committed predicate acts of mail fraud against the Food and Drug Administration ("FDA") in obtaining its approval of abbreviated new drug applications ("ANDAs"). The *Akzo* court ruled that ANDAs, as unissued licenses, were not property in the government's hands for mail fraud purposes, and thus the defendant's conduct before the FDA did not constitute predicate acts for purposes of the federal RICO statute. See id. at 1072-73. The district court viewed ANDAs and patents to be indistinguishable.

On appeal, Samsung distinguishes *Akzo* as involving licenses, in which the government has no financial interest and which therefore are not property. By contrast, under federal patent law and Supreme Court precedent, an issued patent constitutes property. See 35 U.S.C. § 261 ("[P]atents shall have the attributes of personal property."); *Hartford-Empire Co. v. United States*, 323 U.S. 386, 415 (1945). Samsung notes that 35 U.S.C. § 261 does not expressly distinguish between a patent in the hands of the patentee or the government. In fact, the federal government is subject to suit when it infringes a patent that it has granted. See 28 U.S.C. § 1498(a).

Alternatively, Samsung contends that a patent is actually more closely analogous to a franchise than a license. Whereas a license is a promise by the government not to interfere, see *Toulabi v. United States*, 875 F.2d 122, 125-26 (7th Cir. 1989), a franchise is a right that belongs to the government when conferred upon a citizen and that inheres in the sovereign power, see *Borre v. United States*, 940 F.2d 21 5, 220 (7th [27] Cir. 1991). The Seventh Circuit has held that fraud in procuring a franchise is subject to the mail fraud statute. See *Borre*, 940 F.2d at 220. According to Samsung, a patent, like a franchise, enables its owner to exclude others, including the government.

We apply our own law to determine whether SEL's conduct before the PTO qualifies as mail fraud for purposes of the predicate acts requirement of the federal RICO statute. *See Pro-Mold & Tool Co. v. Great Lakes Plastics. Inc.*, 75 F.3d 1568, 1574, 37 USPQ2d 1626, 1631 (Fed. Cir. 1996) (holding that, though we do not have exclusive jurisdiction over unfair competition claims, our own circuit law nonetheless determines when inequitable conduct also constitutes unfair competition). We agree with the district court that inequitable conduct before the PTO cannot qualify as an act of mail fraud or wire fraud for purposes of the predicate act requirement. In the context of the mail fraud statutes, "the words 'to defraud' commonly refer 'to wronging one in his property rights by dishonest methods or schemes' and 'usually signify the deprivation of something of value by trick, deceit, chicane or overreaching.' " *McNally v. United States*, 483 U.S. 350, 358 (1987) (quoting *Hammerschmidt v. United States*, 265 U.S. 182, 188 (1924)).[5]

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[5] We note that, in 1988, Congress added 18 U.S.C. § 1346 in response to *McNally*. Section 1346 provides:

> For purposes of this chapter, the term "scheme or artifice to defraud" includes a scheme or artifice to defraud another of the intangible right of honest services."

On appeal, however, Samsung does not argue that SEL's conduct before the PTO was intended to "defraud another of the intangible right of honest

In this case, however, the PTO has not been defrauded of property. Although that "a patent is property, protected against appropriation both by individuals [22] and by government, has long been settled," *Hartford-Empire*, 323 U.S. at 415, an application that has not yet matured into a patent cannot properly be deemed government property.

We also reject Samsung's attempt to analogize a patent to a franchise for purposes of the mail and wire fraud statutes. A franchise involves a transfer of extant rights previously held exclusively by the sovereign. See *California v. Central Pac. R. Co.*, 127 U.S. 1, 40 (1888). Examples of franchises include cable television and public utilities. See *Borre*, 940 F.2d at 220. By contrast, the patent right to exclude a party from practicing a particular invention is never held by the sovereign, but only by the patentee after issuance.

In short, Samsung has failed to satisfy the predicate act requirement for its federal RICO counterclaims, as SEL's inequitable conduct did not "defraud" the government of any "property" under either the federal mail or wire fraud statutes. Consequently, we hold that the district court properly granted summary judgment dismissing Samsung's federal RICO claims.

B. New Jersey RICO

The district court noted that the New Jersey RICO statute was modeled after the federal statute, see *State v. Ball*, 661 A.2d 251, 258 (N.J. 1995), and that its relevant sections, N.J.S.A. § 2C:41-2(a),(c), also require proof of a pattern of racketeering activity. In view of its rejection of Samsung's mail and wire fraud allegations as predicate acts with respect to the federal RICO counterclaims, the district court

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services," and thus we do not address the possibility of such defrauding here.

concluded that Samsung's New Jersey RICO counterclaims were similarly deficient.

[23] On appeal, Samsung argues that racketeering under the New Jersey RICO Act includes New Jersey crimes as well as "equivalent crimes under the laws of any other jurisdiction," N.J.S.A. § 20:41-l.a. Samsung notes that qualifying predicate acts under the New Jersey statute would include forgery and fraudulent practices, see N.J.S.A. §2C:41-1.a(1)(O), offering a false instrument for filing, see N.J.S.A. § 2C:21-3.b, and making false statements to PTO examiners in violation of federal penal provisions such as 18 U.S.C. § 1001.[6] Samsung contends that the district court ignored these additional state and federal violations and hence improperly dismissed its state RICO claims.

SEL responds that, regardless of the expanded scope of predicate acts under the New Jersey RICO statute, we can still affirm the district court's dismissal of the NewJersey RICO claims on the alternative ground of federal preemption. In dismissing Samsung's federal RICO counterclaims, the district court suggested that RICO claims and the inequitable conduct defense are mutually exclusive remedies. The district court noted that the affirmative defense of inequitable conduct supplies an adequate remedy by rendering the patent

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[6] 18 U.S.C. § 1001 provides:

> Whoever in any matter within the jurisdiction of any department or agency of the United States knowingly or willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious or fraudulent statements on representations, or makes or uses any false writing or document knowing the same to contain any false, fictitious or fraudulent statement on entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both.

unenforceable and possibly also entitling the alleged infringer to attorney fees under 35 U.S.C. § 285.

[24] Samsung disputes that the federal patent laws preempt its state RICO counterclaims, noting that the patent statute nowhere expressly excludes RICO remedies. Samsung claims that SEL's misconduct is not a "garden-variety" instance of inequitable conduct, and emphasizes the Supreme Court's recognition of concurrent RICO and state law remedies for a single activity. *See Humana, Inc. v. Forsyth*, 525 U.S. 299, 303 (1999) (holding that the McCarran-Ferguson Act, which bars application of a federal law in the face of a state law enacted "for the purpose of regulating the business of insurance," did not preclude the concurrent assertion of the federal RICO statute and Nevada insurance law). Samsung also notes that the New Jersey RICO Act states that "[t]he remedies provided in this act shall be cumulative with each other and other remedies at law." N.J.S.A. § 2C:41-6.1.

Samsung underscores the broad remedies available under the RICO statutes. With respect to monetary relief, the patent laws would permit only the recovery of attorney fees, while the New Jersey RICO statute would allow the prevailing plaintiff "threefold any damages he sustains and the cost of the suit, including a reasonable attorney's fee, costs of investigation and litigation." N.J.S.A. § 2C:41-4.c. Samsung asserts that its alleged damages, which include design-around costs and loss of goodwill, are a recognized form of RICO damages. *See. e.g., Khuana v. Innovative Health Care Sys., Inc.*, 130 F.3d 143, 150-51 (5th Cir. 1997), *cert. granted, judgment vacated*, and *case dismissed as moot*, 119 S. Ct. 442 (1998).

Finally, Samsung analogizes its New Jersey RICO counterclaims to the state tort claims held not to be preempted in *Dow Chem. Co. v. Exxon Corp.*, 139 F.3d 1470, 46 USPQ2d 1120 (Fed. Cir. 1998). in *Dow*, we held that the state law claim of intentional [25] interference with actual and

prospective contractual relationships was not preempted by federal patent law, even though the claim was based partly on acts of alleged inequitable conduct before the PTO. We reasoned that because the state cause of action also included elements not found in the patent infringement defense of inequitable conduct, but in the marketplace against inhabitants of the state, the state tort as applied was not an impermissible attempt to offer patent-like protection. See id. at 1477, 46 USPQ2d at 1126. Samsung claims that, like the state claim in Dow, Its RICO counterclaims allege "additional elements not found in the federal patent law cause of action," id. at 1473, 46 USPQ2d at 1123, such as SEL's targeting of Samsung and its eventual filing of this lawsuit.

We agree with SEL that the federal patent laws preempt Samsung's New Jersey RICO counterclaims. As applied, the state RICO counterclaims in this case are more closely analogous to the state abuse of process counterclaim held to be preempted in *Abbott Labs. v. Brennan*, 952 F.2d 1346, 21 USPQ2d 1192 (Fed. Cir. 1991), than the intentional interference with contractual relationship counterclaim in Dow. In *Abbott*, the applicant had committed inequitable conduct by backdating a request for an extension of time and falsely averring that the request had been timely made, resulting in his loss of priority. This court concluded that "the federal administrative process of examining and issuing patents, including proceedings before the PTO's boards, is not subject to collateral review in terms of the common law tort of abuse of process." *id.* at 1357, 21 USPQ2d at 1201.

Like the state abuse of process claim in *Abbott*, "the wrong alleged and for which state law tort damages [are] sought [is] no more than bad faith misconduct before the [26] PTO." *Dow*, 139 F.3d at 1477, 46 USPQ2d at 1126. As pleaded by Samsung, its New Jersey RICO counterclaims occupy a field identical in scope with the inequitable conduct defense. If the conduct constituting inequitable conduct, without more, could

be considered predicate acts under federal or state RICO law, then every accused infringer asserting an inequitable conduct defense would also bring such a RICO counterclaim. An additional state cause of action predicated so squarely on the acts of inequitable conduct would be "contrary to Congress' preemptive regulation in the area of patent law." *Abbott*, 952 F.2d at 1357, 21 USPQ2d at 1201.

Samsung's contention that its New Jersey RICO counterclaims allege additional elements not found in the federal patent law cause of action for inequitable conduct is inaccurate. Samsung conveniently ignores the distinction between acts that may be proven as part of a state RICO violation and those which *must* be proven for liability. As applied by Samsung, the New Jersey RICO statute does not contain as necessary elements of the offense the sorts of acts beyond misrepresentations or willful omissions to the PTO that Samsung alleges in this case. To satisfy the predicate act requirement (and indeed all requirements) of the state RICO statute, Samsung alleges only the act of filing a false statement, but this act completely overlaps with the alleged misrepresentations giving rise to its inequitable conduct defense. Samsung's additional allegations that SEL targeted and intended to assert the '400, '204. and '636 patents against Samsung even before these patents issued do not take Samsung's application of the New Jersey RICO statute outside of the ambit of the inequitable conduct defense. Every patent applicant files its application believing it could assert the resulting patent against infringers (or else seeking the patent would be a worthless [27] endeavor), and it is not unusual for a patent applicant to "target" potential defendants even before the patent issues. Cf MPEP § 708.02(11) (allowing an applicant to file a Petition to Make Special to accelerate prosecution in view of actual infringement by another party). We therefore reject Samsung's attempts to contort the elements of inequitable conduct to satisfy the New

Jersey RICO statute, with its stated purpose of combating organized crime. See *N.J.S.A.* § 2C:41-1.1.c.

Thus, we affirm the district court's grant of summary judgment dismissing Samsung's New Jersey RICO counterclaims as preempted by the patent laws of the United States.[7]

CONCLUSION

The district court did not abuse its discretion in holding the '636 patent unenforceable for inequitable conduct. The district court correctly applied the statute, regulations, and case law, and did not make clearly erroneous findings of fact on materiality and deceptive intent. Under all the circumstances of record, the court did not seriously misjudge the import of the evidence, particularly the degree of materiality as against the level of deceptive intent, in reaching the conclusion that equity warranted rendering the patent unenforceable. In addition, the district court correctly granted [28] summary judgment dismissing Samsung's federal and New Jersey RICO counterclaims, the former as failing to allege legally adequate predicate acts. and the latter as preempted by the patent laws of the United States. Accordingly, we

AFFIRM.

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[7] For a civil federal RICO claim under 18 U.S.C. § 1962(c), the RICO "enterprise" must be distinct from the RICO "person," i.e., the defendant. *See Palmetto State Med. Ctr.. Inc. v. Operation Lifeline*, 117 F.3d 142, 148 (4th Cir. 1997). The district court also dismissed Samsung's federal and state RICO counterclaims on the ground that the alleged SEL "enterprise" consisting of SEL, Dr. Yamazaki, and Mr. Ferguson was insufficiently distinct from the SEL "person." Because we affirm the district court's dismissal of Samsung's respective federal and New Jersey RICO counterclaims as failing to allege a predicate act and as preempted under the circumstances of this case, we decline to reach the correctness of the district court's holding regarding this "enterprise" element.

[29] ADDENDUM B

PTO RULE § 1.56

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the tiling and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

APPENDIX B
(Order on Rehearing)

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

[Filed Mar. 29, 2000]

98-1377, 99-1103

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.,
Plaintiff-Appellant,

v.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
AND SAMSUNG SEMICONDUCTOR, INC.,
Defendants-Cross Appellants.

NOTE: Pursuant to Fed. Cir. R. 47.6, this order is not citable as precedent. It is a public order.

ORDER

A combined petition for rehearing and petition for rehearing en banc having been filed by the APPELLANT, and the petition for rehearing having been referred to the panel that heard the appeal,

Upon consideration thereof,

IT IS ORDERED THAT:

The petition for rehearing is granted for the limited and sole purpose of amending the opinion issued on March 2, 2000 as follows:

On the thirteenth line from the top of page 5, replace "Dr. Yamazaki" with "Kunitaka Yamamoto, SEL's in-house patent agent."

The petition for rehearing en banc is still pending.

FOR THE COURT,

/s/ Jan Horbaly
JAN HORBALY
Clerk

Dated: March 29, 2000

cc: J. Alan Galbraith, Esq.
David J. Healey, Esq.

APPENDIX C
(Order on Rehearing)

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

[Apr. 5, 2000]

98-1377, 99-1103

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.,
Plaintiff-Appellant,

v.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
AND SAMSUNG SEMICONDUCTOR, INC.,
Defendants-Cross Appellants.

CORRECTED

NOTE: Pursuant to Fed. Cir. R. 47.6, this order is not citable as precedent. It is a public order.

ORDER

A combined petition for rehearing and petition for rehearing en banc having been filed by the APPELLANT, and the petition for rehearing having been referred to the panel that heard the appeal,

Upon consideration thereof,

IT IS ORDERED THAT:

The petition for rehearing is granted for the limited and sole purpose of amending the opinion issued on March 2, 2000 as follows:

On the last line of page 5, replace "Dr. Yamazaki" with "Kunitaka Yamamoto, SEL's in-house patent agent."

The petition for rehearing en banc is still pending.

FOR THE COURT,

/s/ Jan Horbaly
JAN HORBALY
Clerk

Dated: April 5, 2000

cc: J. Alan Galbraith, Esq.
David J. Healey, Esq.

APPENDIX D

Obviousness Ruling

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF VIRGINIA
ALEXANDRIA DIVISION

C.A. No. 96-1460-A

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.
Plaintiff,

vs

SAMSUNG ELECTRONICS CO., LTD., *et al.*,
Defendants.

The above-entitled matter came on to be heard in the United States District Court, Alexandria, Virginia, commencing at 10 a.m. on March 6, 1998.

BEFORE: The Honorable JAMES C. CACHERIS, Presiding United States District Judge

* * * *

[6] THE COURT Okay. I'm ready to rule on this one.

This matter is before the Court on Defendant's Motion for Summary Judgment Declaring U.S. Patent 5,543,636, the '636 patent referred to in this case, Invalid as Obvious under 35 USC Section 103.

Plaintiff, Semiconductor Energy Laboratory Co., Ltd., alleges that Defendants Samsung Electronics Company, Samsung Electronics America, and Samsung Semiconductor, Inc. infringed its '636 patent. The '636 Patent describes a type of insulated gate field effect transistor, the IGFET. Defendants claim that the patent is invalid because it involves a combination of concepts which would have been

[7] obvious to a person of ordinary skill in the art at the time of the patent application.

The '636 Patent describes an IGFET with a concentration level of the impurity atoms oxygen, carbon, and nitrogen below $5x10^{18}$ atoms per cubic centimeter in the channel region. For purposes of this motion, the parties apparently agree that at the time of the patent application, conventional IGFETs were well known, as were methods for obtaining the specified level of impurity. Defendants argue that based on this knowledge, the method impurity level in the channel region would have been obvious to one skilled in the art.

Summary judgment is appropriate only if "the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show there's no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law." *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 247 (1986); Fed. R. Civ. P. 56(c). "A district court must grant summary judgment if, after an adequate time for discovery, a party fails to make a showing sufficient to establish the existence of an essential element of that party's case." *Baber v. Hospital Corp. of America*, 977 F.2d 872, 874 (4th Cir.1992) (citation omitted).

[8] However, a court may only grant a summary judgment motion "if the non-movant failed to make a sufficient showing on an element on which he had the ultimate burden of proof." *Brock v. Entre Computer Ctrs., Inc.*, 933 F.2d 1253, 1259 (4th Cir. 1991) (citation omitted).

"The mere existence of a scintilla of evidence in support of the party's position would be insufficient; there must be evidence on which the jury could reasonably find for that party." *Anderson*, 477 U.S. 252. In reviewing the evidence submitted by the parties, "the court must draw any inferences in the light most favorable to the non-movant." *Brock*, 933 F.2d at 1259 (citation omitted).The court must ultimately

"determine whether the record taken as a whole could lead a reasonable trier of fact to find for the non-movant." The Brock case.

Patents are presumed to be valid under 35 USC Section 282, and invalidity because of obviousness must be, demonstrated by clear and convincing evidence.

Para-Ordinance Manufacturing, Inc. v. SGS Importers Int'l, Inc., 73 F.3d 1085 (Fed. Cir. 1985).

35 USC Section 103(a) states:

> "A patent may not be obtained if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the [9] invention was made to a person having ordinary skill in the art to which said subject matter pertains.

The determination of obviousness is a matter of law and is based on findings of fact relating to the scope and content of the prior art, the differences between the claimed invention and the prior art, and the level of ordinary skill in the art. *Para-Ordinance Mfg., Inc.*, 73 F.3d at 1088; *Glaverbel Societe Anonyme Ordinance Mfg., & Supply, Inc.*, 73 F.3d, 1550, 1555 (Fed. Cir. 1995). When present, objective evidence such as commercial success, copying or long-felt need must be considered. The *Glaverbel* case. Obviousness may not be established using hindsight or in view of the inventor's teachings or suggestions.

In opposition to Defendants' Motion, Plaintiff cites a report of its expert, Dr. Gerald Lucovsky, "Report" In the report Dr. Lucovsky describes the scope and content of the prior art, the differences between the '636 Patent and the prior art, and the level of ordinary skill in the art at the time of the application.

Dr. Lucovsky states that prior to the application for the '636 Patent, no one had suggested that impurities in the

channel region of a thin film transistor, "TFT", a type of IGFET, have any effect on performance or reliability. Report, paragraph 44. Therefore, according to Dr. Lucovsky, [10] any argument that the claims at issue in the '636 Patent are obvious could only be based entirely on hindsight.

In its Motion for Summary Judgment, Defendants argue that this Court can conclude that the '636 Patent is obvious by examining statements made by the inventor, Dr. Yamazaki, and reviewing the prior art. However, after reviewing the materials cited by Defendants, this Court cannot find that from the perspective of a person of ordinary skill in the art at the time of the patent application, the claims would have been obvious. Simply put, Defendants do not provide an expert report or any other clear and convincing evidence refuting Dr. Lucovsky's claims.

Therefore, Defendants failed to meet their burden of demonstrating invalidity for obviousness. Accordingly, Defendants' Motion for Summary Judgment Declaring the '636 Patent Invalid as Obvious under 35 USC Section 103 is denied.

APPENDIX E

(Dismissal of RICO Counterclaims, 4 F.Supp.2d 473-77)

UNITED STATES DISTRICT COURT
E.D. VIRGINIA
ALEXANDRIA DIVISION

No. CIV. A. 96.1460-A

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.,
Plaintiff;

v.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG. ELECTRONICS AMERICA, INC., AND
SAMSUNG SEMICONDUCTOR, INC.,
Defendants.

March 20,1996

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[474] MEMORANDUM OPINION

CACHERIS, District Judge.

This case is before the Court on Plaintiffs Motion for Summary Judgment on Defendants' Racketeer Influenced and Corrupt Organizations ("RICO") Counterclaims.

I.

Plaintiff, Semiconductor Energy Laboratory Co., Ltd. ("SEL") originally alleged that Defendants Samsung Electronics Company, Samsung Electronics America, and

Samsung Semiconductor, Inc. (collectively "Samsung") infringed three of its patents. SEL has since dismissed its claims as to two of the patents. Samsung filed a counterclaim alleging antitrust violations as well as violations of Title IX of the Organized Crime Control Act of 1970, 18 U.S.C. Sections 1961-1968, or the RICO statute, and its New Jersey counterpart, New Jersey Statute 2C:41-2. Samsung argues that SEL fraudulently obtained the three patents originally at issue in this lawsuit and then filed infringement claims against Samsung in an effort to receive money for the patents.

II.

[475] Summary judgment is appropriate only if "the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law." *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 247, 106 S.Ct. 2505, 91 L.Ed.2d 202 (1986); Fed.R.Civ.P. 56(c). "A district court must grant summary judgment if, after an adequate time for discovery, a party fails to make a showing sufficient to establish the existence of an essential element of that party's case." *Baber v. Hospital Corp. of Am.*, 977 F2d 872, 874 (4th Cir.1992). However, a court may only grant a summary judgment motion "if the non-movant failed to make a sufficient showing on an element on which he had the ultimate burden of proof." *Brock v. Entre Computer Ctrs., Inc.*, 933 F.2d 1253, 1259 (4th Cir.1991).

"The mere existence of a scintilla of evidence in support of the [party's] position will be insufficient; there must be evidence on which the jury could reasonably find for th[at] [party]." *Anderson*, 477 U.S. at 252. In reviewing the evidence submitted by the parties, "the court must draw any inferences in the light most favorable to the non-movant" *Brock*, 933 F.2d at 1259. The court must ultimately

"determine whether the record taken as a whole could lead a reasonable trier of fact to find for the non-movant" *Id.*

III.

Samsung claims that SEL violated 18 U.S.C. Section 1962(a) and (c).[1] To prove RICO violations, the RICO plaintiff must demonstrate a "pattern of racketeering activity" which must consist of at least two instances of racketeering activity. 18 U.S.C. § 1961(5); *Mylan Lab., Inc. v. Matkari.*, 7 F.3d 1130, 1135 (4th Cir.1993). In this case, Samsung asserts a "three-party pass-through fraud structure", arguing that SEL committed numerous acts of mail and/or wire fraud[2] on the United States Patent and Trademark Office ("PTO") which resulted in approval of certain patent applications. According to Samsung, SEL then sought money from Samsung and others by threatening them with litigation over these fraudulently obtained patents. Put another way, Samsung claims that SEL defrauded the PTO, but the intended, albeit indirect, victim of the fraud is Samsung.

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[1] Section 1962(a) and (c) state:

> (a) It shall be unlawful for any person who has received any income derived, directly or indirectly, from a pattern of racketeering activity to use or invest, directly or indirectly, any part of such income, or the proceeds of such income, in acquisition of any interest in, or the establishment or operation of, any enterprise which is engaged in, or the activities of which affect, interstate or foreign commerce.
>
> (c) It shall be unlawful for any person employed by or associated with any enterprise engaged in, or the activities of which affect, interstate or foreign commerce, to conduct or participate, directly or indirectly, in the conduct of such enterprise's affairs through a pattern of racketeering activity[.]

[2] *See* 18 U.S.C. § 1341, 1343.

Mail and wire fraud are both predicate acts of racketeering activity for RICO purposes. 18 U.S.C. § 1961(1). However, SEL argues that the PTO cannot be "defrauded" of approval of patent applications under the federal mail and wire fraud statutes. Specifically, SEL argues that the PTO does not lose money or property when it grants a patent, therefore, in granting a patent, the PTO cannot be the victim of mail or wire fraud.

In support, SEL cites *Mylan Lab., Inc. v. Akzo, N.V.*, 770 F.Supp. 1053, 1071-73 (D.Md.1991). In that case, the RICO plaintiff alleged that the defendants committed predicate acts of fraud against the Food and Drug Administration ("FDA") in obtaining FDA approval of their abbreviated new drug applications ("ANDAs"). The District of Maryland ruled that an unissued license is not property in the government's hands for fraud purposes, therefore, the defendants' conduct before the FDA did not amount to predicate acts under RICO.[3] *Mylan Lab., Inc. v. Akzo,* [476] N.V., 770 F.Supp. at 1072-73. Although the Fourth Circuit reversed a related decision in *Mylan Lab., Inc. v. Matkari, supra.*, it expressly stated "[We affirm a ruling that precludes Mylan from relying on, as its sole basis for the predicate acts in its RICO counts, the theory that the FDA *was* defrauded out of its ANDA approvals within the meaning of the mail and wire fraud statutes." *Mylan Lab., Inc. v. Matkari* 7 F.3d at 1137.

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[3] The court declined to follow the Third Circuit's decision on this issue in *United States v. Martinez*, 905 F.2d 709, 715 (3rd Cir.1990), and instead followed the decisions of the First, Second, Sixth, Seventh, Eighth and Ninth Circuits. *Mylan Lab., Inc. v. Akzo. N.V.* 770 F.Supp. at 1072 (citing, e.g., *McEvoy Travel Bureau, Inc. v. Heritage Travel, Inc.*, 904 F.2d 786, 792-93 (1st Cir.1990). *United States v. Schwartz*, 924 F.2d 410, 417 (2nd Cir.1991), *United States v. Murphy*, 836 F.2d 248, 254 (6th Cir.1988). *Toulabi v. United States*, 875 F.2d 122, 125 (7th Cir.1989) *United States v. Granberry*, 908 F.2d 278. 280 (8th Cir.1990), *United States v. Kato*, 878 F.2d 267, 268-69 (9th Cir.1989)).

In response, SEL argues that *Mylan Lab., Inc. v. Akzo, N.V.* and the cases it cites are distinguishable because they involved licenses, not patents, and patents involve valuable property interests. In addition, Samsung argues that by deceiving the PTO, SEL deprived Samsung and others of the "intangible right of honest services" in violation of the mail fraud statute. *See* 18 U.S.C. § 1346.

Samsung cites no cases which indicate that approval of a patent application by the PTO should be treated differently than approval of an ANDA by the FDA. In both cases, the United States confers certain rights, but it does not forfeit anything. Just as the FDA does not lose money or property when it grants a license, the PTO does not lose money or property when it issues a patent. In addition, Samsung makes no allegations and no evidence indicates that the PTO provided anything less than honest services or that SEL intended for them to provide dishonest services. Furthermore, there is no claim by Samsung that it had an intangible right to SEL's honest services.

Because SEL's alleged conduct before the PTO does not violate the federal mail and wire fraud statutes, that conduct cannot satisfy the predicate acts requirement under RICO. If such conduct could properly be-considered predicate acts, then nearly every inequitable conduct claim in a patent case could be brought as a RICO claim. However, the Patent Act imposes a severe penalty for those who mislead or wrongfully withhold information in an attempt to obtain a patent: all claims in the patent will be rendered unenforceable. *See, J.P. Stevens & Co., Inc. v. Lex Tex, Ltd, Inc.*, 747 F.2d 1553. 1561 (Fed.Cir.1984). Additionally, if Samsung can prove its allegations, not only will the patents at issue be rendered unenforceable, but Samsung may be entitled to attorney's fees pursuant to 35 U.S.C. Section 285. Through these provisions, the Patent Act provides appropriate remedies for

the type of misconduct from which Samsung seeks to recover in its RICO claims.

In its counterclaim, Samsung alleges that SEL's fraudulent acts also include "numerous use of mail and/or wire fraud on Samsung and others[.]" Samsung's Amended Answer and Counterclaim, § 117. However, while the evidence indicates that some companies own licenses to the relevant patents, Samsung has not provided evidence that SEL has committed mail or wire fraud with respect to Samsung or others. Rather, Samsung relies on the theory that SEL's alleged fraud on the PTO satisfies the predicate acts requirement. Because Samsung provides no evidence on which a jury could reasonably find the predicate acts necessary to sustain a RICO claim, SEL is entitled to summary judgment on this issue.

The New Jersey RICO statute is modeled after the federal statute, *State v. Ball*, 141 N.J. 142, 661 A.2d 251, 258 (1995), and the relevant sections, 2C:41-2(a) and (c), require proof of a pattern of racketeering activity. Samsung relies on the same predicate acts in support of its New Jersey RICO claim. Because those acts do not support a federal RICO violation, they fail to support a New Jersey RICO violation.

In addition, Samsung fails to satisfy the "enterprise" element of Section 1962(c). Samsung argues that the RICO enterprise consists of SEL, Dr Shunpei Yaznazaki (SEL's president), and Gerald Ferguson (SEL's patent attorney) However, the Fourth Circuit has ruled that under Section 1962(c), the RICO enterprise and the defendant must be distinct. *Palmetto State Med. Ctr., Inc. v. Operation Lifetime*, 117 F.3d 142, 148 (4th Cir.1997).

Samsung contends that SEL, Yamazaki, and Ferguson should be considered separate entities because each had a duty to the PTO, and Yamazaki and Ferguson committed independent acts of fraud on the PTO. However, "[B]y alleging a RICO enterprise that consists merely of a corporate defendant associated with its own employees or agents carry-

ing on the regular affairs of the defendant, the distinctness requirement may not be circumvented." *Riverwoods Chappaqua Corp. v. Marine Midland Bank, NA.*, 30 F.3d 339, 344 (2nd Cir.1994) (citations omitted); *see also Disccm, Inc. v. NYNEX Corp.*, 93 F.3d. 1055, 1063 (2nd Cir.l996Xattorneys acting on behalf of corporation are agents under *River-woods Chappaqua Corp.).*

SEL generates its income by obtaining and licensing patents. It does not manufacture or distribute any products. Samsung does not argue that Yamazaki or Ferguson acted beyond the scope of their agency when they committed the alleged misconduct. Therefore, because the RICO enterprise is not distinct from the RICO defendant in this case, SEL is entitled to summary judgment on Samsung's Section 1962(c) claims.

For these reasons, Samsung fails to make a showing sufficient to establish the existence of the essential elements of its RICO claims. Accordingly, SEL's Motion for Summary Judgment on Samsung's Racketeering Counterclaims is GRANTED.

An appropriate Order granting summary judgment in favor of SEL on Counts Six, Seven, Eight, and Nine of Samsung's counterclaim shall issue.

ORDER

In accordance with the accompanying Memorandum Opinion, it is hereby Ordered that:

1) Plaintiff Semiconductor Energy Laboratory Co., Ltd.'s Motion for Summary Judgment on Defendants Samsung Electronics Company, Samsung Electronics America, and Samsung Semiconductor, Inc.'s RICO Counterclaim is GRANTED as to Counts Six, Seven, Eight, and Nine; and

2) the Clerk shall forward copies of this Order and accompanying Memorandum Opinion to all counsel of record.

APPENDIX F

(Initial UnenforceabilityRuling, 4 F.Supp.2d 477-97)

UNITED STATES DISTRICT COURT,
E.D. VIRGINIA

C.A. No. 96-1460-A.
APRIL 15, 1998.

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.,
Plaintiff.

v.

SAMSUNG ELECTRONICS CO., LTD., SAMSUNG ELECTRONICS AMERICA, INC., and SAMSUNG SEMICONDUCTOR, INC.,
Defendants.

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[479] MEMORANDUM OPINION

ELLIS, District Judge.

In this patent infringement action, plaintiff Semiconductor Energy Laboratory Co. ("SEL") alleges that defendants Samsung Electronics, Samsung Electronics America, and Samsung Semiconductor, (collectively "Samsung") made or sold active matrix display units that infringe SEL's U.S. Patent No. 5,543,636 ("the '636 patent"). Among its defenses to SEL's charge of infringement, Samsung alleges that the '636 patent is unenforceable owing to SEL's inequitable conduct before the Patent and Trademark Office ("PTO"). Between March 17, 1998 and April 3, 1998, a seven-day bench trial was held on Samsung's affirmative defense of inequitable conduct, during which time the Court heard fact and expert opinion testimony from several witnesses, admitted into evidence numerous exhibits, and considered the parties' written and oral arguments. This Memorandum

Opinion sets forth the Court's findings of fact and conclusions of law, as announced from the bench pursuant to Fed.R.Civ.P. 52(a). But, to begin with and before listing the detailed findings and conclusions, it is useful as context to describe briefly the parties, the pertinent patents, and the genera] law of inequitable conduct. Indeed, the settled legal principles of the doctrine of inequitable conduct are the lens through which the factual record must be examined and weighed.

I.

SEL is a Japanese research and development company that specializes in semiconductor technology. Over the past eighteen years, SEL has filed over 5,000 patent applications worldwide, and has been awarded approximately 1,500 U.S. and foreign patents for its inventions. Dr. Shunpei Yamazaki, the president and majority shareholder of SEL, is the inventor or co-inventor on most of SEL's patents, including the '636 patent.

SEL filed its application for the '636 patent, titled "Insulated Gate Field Effect Transistor," on June 7, 1995, and the patent issued on August 6, 1996. SEL is the owner of the '636 patent. The asserted claims of the '636 patent (claims 1-3 and 5) are generally directed to a thin film transistor ("TFT"), a type of insulated gate field effect transistor ("IGFET") used in active matrix display units. Active matrix displays, which are commonly used as screens in laptop computers, have thousands of pixels that create a picture or image. The pixels are turned on and off by TFT's. The invention claimed in the '636 patent is a TFT with a semiconductor layer made of intrinsic amorphous silicon having a channel region sandwiched between a silicon nitride gate insulator and another insulator, wherein the concentration of impurities (*e.g.*, carbon and oxygen) in the channel region are 5×10^{18} atoms/cm or less. It is the combination of the specific structure together with the low impurity levels that constitutes the invention.

In October 1996, SEL brought this infringement action against the Samsung defendants, a group of companies engaged, *inter alia*, in the manufacture and sale of active matrix displays as well as laptop computers containing active matrix displays. Specifically, SEL's complaint alleges that the active matrix display units made and sold by Samsung infringe the '636 patent. Initially, SEL's complaint also included claims for in fringement of U.S. Patent Nos. 5,349, 204 ("the '204 patent") and 5,521,400 ("the '400 patent"). However, on March 4, 1998, an agreed order was entered withdrawing the '204 and the '400 patents from the action, thereby leaving the '636 patent as the sole remaining patent-in-suit.

[480] Samsung alleges, as an affirmative defense, that the '636 patent is unenforceable owing to SEL's inequitable conduct before the PTO in connection with three separate patent applications: (i) the application for the '636 patent itself; (ii) the application for U.S. Patent No. 5,315,132 ("the '132 patent"); and (iii) the application for the '204 patent.

The relationship of these patents to each other is pertinent to the disposition of the issue at bar. In this regard, the genealogy of the '636 and '132 patents is well illustrated in SEL's Exhibit No. 432, which is attached to this Memorandum Opinion as an appendix. In essence, the '132 patent is antecedent to, in the direct priority chain of the '636 patent. Specifically, the '636 patent resulted from continuation and divisional applications from the application that issued as the '132 patent. The priority date of the '636 patent thus relies on the chain of applications that includes the '132 patent. Further, because the subject matter of the '636 patent is so closely related to the '132 patent, a terminal disclaimer was filed with respect to the '636 patent, giving it

the expiration date of the '132 patent.[1] Both the '132 and the '636 patents rely upon the May 18, 1984 filing date for SEL's Japanese laid-open Application No. 59-100250 ("the '250 application"), which has a "one-to-one" relationship with both the '132 and the '636 patents. Both patents have the same inventor (Dr. Yamazaki), owner (SEL), disclosure, specification, and title. The '132 patent issued on May 24, 1994, resulting from an application that was filed on December 8, 1992.

The '204 patent is not a part of the '250 application-'132-'636 chain. Yet, like the '636 patent, the '204 patent claims an invention related to low levels of impurities, contains similar prior art references, and was prosecuted at roughly the same time as the '636 patent. Specifically, the '204 patent issued on September 20, 1994, based on an application filed on December 7, 1993.

In support of its inequitable conduct defense, Samsung alleges that SEL made deliberate, material misrepresentations to, and withheld material prior art references from, the PTO during its prosecutions of these three applications. The specifics of these allegations for each patent are set forth as a preface to the findings for that patent. In essence, Samsung argues that SEL's misconduct during each of these three patent prosecutions is sufficient to render all of the claims of the '636 patent unenforceable for the life of the patent.

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[1] In this regard, the 132 patent also claims a TFT with the same low levels of impurities as are claimed in the '636 patent. As Dr. Yamazaki testified during the hearing, the "essential nature of the ['636 & '132] invention[s]" is the same. The difference between the two patents is that the asserted claims of the '636 patent are narrower than the claims of the '132 patent. For example, the '132 patent is not limited to an IGFET with a *silicon nitride* gate, or an *intrinsic* silicon layer, while the claims of the '636 patent are so limited.

II.

It is fundamental that all applicants for patents have a duty to prosecute patent applications in the PTO with candor, good faith, and honesty. *See Precision Instrument Mfg. Co. v. Automotive Maintenance Mach. Co.*, 324 U.S. 806, 818, 65 S.Ct. 993, 89 L.Ed. 1381 (1945). The vital importance of this duty cannot be overstated. Without it, the edifice of patent law cannot stand. Indeed, the cornerstone presumption of an issued patent's validity, and the placement of a heavy burden on the infringer to show invalidity, both rest on the proper fulfillment of this duty.

A breach of this duty of candor, good faith, and honesty constitutes inequitable conduct,[2] and renders all claims of the patent involved unenforceable. *See Molins PLC v. Textron, Inc.*, 48 F.3d 1172, 1178 (Fed.Cir.1995). And inequitable conduct includes "affirmative misrepresentation of a material fact, failure to disclose material in formation, or submission of false material information, coupled with an intent to deceive." *Id.* The party raising the affirmative defense of inequitable conduct must offer clear and convincing evidence that the conduct is both material and intended. *See id.*[3] More specifically, the doctrine of inequitable conduct requires the trial court to undertake a two-step analysis. *See Halliburton Co. v. Schlumbeger Tech. Corp.*, 925 F.2d 1435, 1439 Fed.Cir.1991). First, the court must discern whether the withheld references or misrepresentations satisfy a threshold

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[2] Inequitable conduct is simply "the unclean hands doctrine applied to particular conduct before the PTO." *Consolidated Aluminum Corp. v.Foseco Int'l Ltd.*, 910 F.2d 804, 812 (Fed.Cir.1990).

[3] Clear and convincing evidence is evidence "which proves in the mind of the trier or fact 'an abiding conviction that the truth of [the] factual contentions [is] "highly probable." ' " *Intel Corp. United States Int'l Trade Comm'n* 946 F.2d 821, 830 (Fed.Cir.1991) (quoting *Colorado v. New Mexico*. 467 U.S. 310, 316, 104 S.Ct. 2433, 31 L.Ed.2d 247 1984)).

level of materiality. *See Id.* The court must also determine whether the applicant's conduct in this regard satisfies a threshold showing of intent to mislead. *See id.*[4] Next, assuming satisfaction of the thresholds, "the trial court must balance materiality and intent. . . . The more material the omission [or misrepresentation], the less culpable the intent required, and vice versa." *Id.* Finally, an equitable judgment must be made that, "in light of all the particular circumstances, the conduct of the patentee is so culpable that its patent should not be enforced." *LaBounty Mfg., Inc. v. United States Int'l trade Comm'n,* 958 F.2d 1066, 1070 (Fed.Cir.1992).

Materiality is defined at 37 C.F.R. § 1.56 (Rule 56), and, as the Federal Circuit teaches,[5] this is the starting point in the materiality analysis. Thus, since 1992,[6] Rule 56 has provided, in pertinent part, as follows:

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[4] It is worth noting that a finding of gross negligence itself is insufficient to satisfy the intent threshold. *See Tom Kingsdown Med. Consultants Ltd. v. Hollister Inc.*, 863 F.2d 807, 876 Fed.Cir. 1988). At the same time however the precise content of the intent "threshold" remains essentially undefined. In any event, the defense of inequitable conduct will not succeed in rendering a patent unenforceable unless it is shown by clear and convincing evidence that the offending conduct was material and done with an intent to deceive.

[5] *See Critikon, Inc. v. Becton Dickinson Vascular Access, Inc.*, 120 F.3d 1253, 1257 (Fed.Cir.1997).

[6] Prior to the 1992 amendment, Rule 56 defined information as material when "there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent." 37 C.F.R. § 156 (1989). The Federal Circuit has not discussed the meaning of the new Rule 56 which appears narrower, i.e., less information is defined as material, than the former version of Rule 36. Nevertheless, the new (1992) version of Rule 36 does not purport to alter the previously settled principle that a "but for" test is inappropriate determinations of materiality. *See Merck & Co., Inc. v. Dambury Pharmacal Inc.*, 373 F.2d 1418, 1421 (Fed.Cir.1989) (rejecting "but for"

information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim:[7]

or

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standard of materiality under pre-1992 Rule '56). In other words, Materiality does not require a finding that "but for" the inequitable conduct, the patent would not have issued.

Also worth noting is that the new version of Rule 36 does not refer to a hypothetical reasonable examiner or to any standard for an examiners competence. Application of the new rule does not require the use of any such standard. In any event, it is clear that patent examiners are not presumed to be omniscient, *i.e.*, to know all the prior art. together with its relevance and significance. Were this not so, there would be no need for a duty of disclosure of prior art. But this duty is vital given that patent prosecution proceedings are typically ex parte. and examiners, while technically skilled, are not omniscient. Consistent with this, examiners are properly characterized as "quasi-judicial officials trained in the law and presumed to 'have some expertise in interpreting the [prior art] references and to be familiar from their work with the level of skill in the art and whose duty it is to issue only valid patents.' " *Markman v. Westview Instruments*, Inc., 52 F.3d 967. 986 (Fed.Cir.1995) (quoting *American Hoist & Derrick Co. v.* Sowa & Sons, *Inc.*, 725 F.2d 1350, 1359 (Fed.Cir.1984)). Thus, examiners are skilled in the art insofar as they are technically competent to understand information and references in some technical or scientific field, but they are not of ordinary skill in the art to the extent that this might imply that they are aware of all the pertinent prior art.

[7] Rule 56 further provides that "[a] prima facie ease of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patent ability." 37 C.F.R. § 1.56(6).

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

Thus, under the new Rule 56, materiality is phrased in terms of whether a misrepresentation, if corrected, or an omitted reference, if disclosed, would, itself or together with other information, give rise to a *prima facie* (*i.e.*, rebuttable) case of unpatentability. If so, the omitted reference or misrepresentation is material. But this is not the only test of materiality. The omitted reference or misrepresentation may also be material if it refutes or is inconsistent with the applicant's patentability arguments.

Whether a withheld reference or omitted information is cumulative plays a prominent role in this case. Thus, it is important to note that while cumulative information is not material under Rule 56, a withheld reference may be highly material when it discloses a more complete combination of relevant features, even if those features are before the patent examiner in other references. *See, e.g., Molins*, 48 F.3d at 1180; *LaBounty*, 958 F.2d at 1075-76; *In re Jerabek*, 789 F.2d 886, 890 (Fed.Cir.1986). Thus, where, as here, the invention is a combination of elements, an undisclosed prior art reference that contains more of the combined elements than the disclosed references is not cumulative simply because various elements of the invention appear in other disclosed references.

Inequitable conduct requires more than mere materiality of the withheld or misrepresented reference or information; it also requires an intent to act inequitably. And no presumption of intent to deceive arises merely from the materiality of an undisclosed reference. *See Halliburton*, 925 F.2d 1435, 1442. Even gross negligence "does not of itself justify an inference

of intent to deceive." *Id.* Rather, such conduct "can support an inference of intent only when, 'viewed in light of all the evidence, including evidence indicative of good faith,' the conduct is culpable enough 'to require a finding of intent to deceive.' " *Id.* (quoting *Kingsdown*, 863 F.2d at 876). Yet, it is also true that a patentee facing a "high level of materiality and clear proof that it knew or should have known of that materiality, can expect to find it difficult to establish 'subjective good faith' sufficient to prevent the drawing of an inference of intent to mislead." *Critikon*, 120 F.3d at 1257. In such circumstances, a "mere denial of intent to mislead (which would defeat every effort to establish inequitable conduct) will not suffice." *Id.*

The test, then, requires a consideration of, and a judgment on, the totality of the circumstances. In the words of the Federal Circuit, courts must determine whether the conduct "in its totality manifests a sufficiently culpable state of mind to warrant a determination that it was inequitable." *Molins*, 48 F.3d at 1181. This sensible formulation recognizes that direct proof of intent is rarely available and that it is impossible to scrutinize directly the workings of the human mind.

It is against these general legal principles that Samsung's claims of inequitable conduct must be assessed. Thus, analysis of Samsung's claims will proceed by an initial assessment as to the materiality of any withheld or mischaracterized information during SEL's prosecution of the '636, '132, and '204 patent applications. An assessment of SEL's intent will follow.

III.

A. The '636 Patent Application

Samsung alleges two specific instances of inequitable conduct by SEL during its prosecution of the '636 patent. First, SEL submitted to the PTO as prior art the Japanese laid-open Application No. 56-135968, assigned to Cannon K.K.

("the Canon '968 application"), which is also directed to TFT's. Specifically, SEL submitted the full 29-page Japanese language version and a one-page partial English translation of the Canon '968 application. Samsung contends that by highlighting, through translation, only one of the many elements in the Canon reference that was relevant to the '636 application, and by leaving the others untranslated, SEL deliberately mischaracterized the importance of Canon and attempted to conceal material information from the examiner. Second, SEL also revealed as prior art a 1983 article by Dr. CC. Tsai titled "Amorphous Si Prepared in a UHV Plasma Deposition System," which teaches the reduction of impurities in amorphous silicon to improve performance in electronic devices. SEL distinguished the Tsai article before the PTO by claiming that it applied primarily to solar cells and not TFT's, and by stating that the current in the devices discussed in the article runs in a perpendicular direction, while the current in the type of TFT's referred to in the '636 patent runs in a parallel direction. Samsung alleges that SEL's statements in this regard were disingenuous attempts to distinguish the Tsai article from the '636 patent application, and that they were contrary to its own knowledge and inconsistent with its own position in other patent applications.

1. The Canon '968 Application

On November 15, 1993, in connection with its '636 patent application, SEL disclosed approximately 90 references of prior art to the PTO, including the Canon '968 application. SEL submitted the full 29-page Japanese language version of the Canon '968 application to the PTO, but not a full English translation. Instead, it submitted a one-page document titled "Partial Translation of JP-Laid Open 56-135968:" which selectively translated for the PTO sections of the application appearing both before and after the untranslated portions of the Canon '968 application. Dr. Yamazaki testified that the

partial translation had already been prepared in connection with another patent application, and that he made the decision that only certain portions of the Canon '968 application should be translated and submitted to the PTO together with the full Japanese language version in connection with the '636 application.

The partially translated portion of the Canon reference discloses a silicon nitride gate insulator, one of the elements of the asserted claims of the '636 patent. Dr. Yamazaki testified that at the time he submitted the partially translated Canon '968 reference, the silicon nitride gate insulator was the only disclosure in the Canon '968 application that he believed to be relevant to the '636 patent. Indeed, when he disclosed the Canon '968 application to the PTO, he identified its relevance only as "disclos[ing] the use of silicon nitride for a gate insulating layer of a thin film transistor."

Yet, this was not accurate; the untranslated portions of the Canon '968 application 'were also relevant to a consideration of the patentability of the invention claimed in the '636 patent. In general, these portions were (a) the frequent admonitions to prevent or limit atmospheric impurities in semiconductor materials[8] which provide an express suggestion to employ teachings such as those found in the Tsai article or the '423 or the '488 applications[9] to reduce carbon, oxygen and nitrogen impurities below the levels claimed in the '636 patent, and (b) a description of the same structure for a thin film transistor as is described in the '636 patent. More specifically, the untranslated portion of the

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[8] In this regard, and indeed generally, the Court credits the testimony of Samsung's witnesses Dr. Fonash, Dr. Tsai, and Dr. Meyerson over SEL's witnesses Dr. Lucovsky, Dr. Yamazaki whenever there is a conflict.

[9] That is SEL's Japanese laid-open Application No. 59-33423 "the 423 application" 59-33488 ("the 488 application"), which were laid open (published in Japan) on February 27, 1984.

Canon '968 teaches avoiding exposure of the channel region to impurities resulting from air or oxygen. Further, the untranslated portion teaches the cleaning of the substrate by etching part of it away, prior to depositing the amorphous silicon. Further, it teaches that the substrate can introduce impurities, and that washing alone is insufficient to avoid impurities. Although other prior art disclosed by SEL during the prosecution of the '636 patent, such as the Tsai article,[10] teach avoidance of impurities, none [484] disclose or teach the processing sequence useful in avoiding impurities, such as etching the substrate. The translated portion of the Canon '968 application submitted by SEL to the PTO omitted this teaching.

It is also significant that the translated portion of the Canon '968 application describes a TFT structure that is somewhat different from that described in the '636 patent, whereas the structure described in the untranslated portion of the Canon '968 application describes the same structure found in the '636 patent. Thus, the structure described in the untranslated portion of the Canon '968 application has the same intrinsic semiconductor layer made from amorphous silicon; the same channel region sandwiched between the insulators; and (in both the translated and the untranslated portions), the same silicon nitride gate insulator as claimed in the '636 patent. To be sure, other references cited to the PTO disclose the various elements described in the '636 patent claims. Yet, no other reference before the examiner contained as complete a combination of the '636 elements as is disclosed in the untranslated Canon '968 application.

Thus, contrary to SEL's contention, Dr. Fonash's testimony convincingly establishes that the untranslated

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[10] Findings relating both to the nature of the Tsai article and to Dr. Yamazaki's and SEL's knowledge of it are set forth in the following sections.

portions of Canon are not merely cumulative, as they contain a more complete combination of the elements-the intrinsic amorphous silicon, the silicon nitride gate insulator, and the admonition to avoid impurities—that are claimed in the '636 patent itself.[11] Dr. Fonash further convincingly testified that the untranslated portions of the Canon '968 application and the Tsai article, taken together, would disclose a device having every element of the asserted claims of the '636 patent. As Dr. Fonash put it, a fully translated Canon '968 application provides a "good blueprint" for making the exact device described in the '636 patent, and additionally provides the admonition to avoid impurities. The Tsai article, discussed *infra* in more detail, discussed amorphous silicon films with specific low levels of impurities within the claim limitations of the '636 patent. Thus, Dr. Fonash concluded that the fully translated Canon '968 application, when taken together with the Tsai article, renders obvious the asserted claims of the '636 patent. Moreover, he concluded that failing to disclose the untranslated portions of the Canon application would significantly hinder a patent examiner's ability to determine whether the '636 patent application was an unobvious advancement over the prior art. In a grudging admission of this, Dr. Yamazaki testified during the inequitable conduct hearing that submitting a complete translation of the Canon '968 application would have been a "kinder thing" for him to do, and that a full translation "would be more convenient" for the PTO.

Accordingly, the evidence is clear and convincing that untranslated portions of the Canon '968 application contained information highly material to the prosecution of the '636 patent application as they, together with other information, establish a *prima facie* case of unpatentability. *See* 37 C.F.R.

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[11] Worth nothing in this regard is that Dr. Yamazaki acknowledged his duty to provide the PTO with prior art references "most simlar to" his claimed invention.

§ 1.56. The evidence is also clear and convincing that the fully translated Canon '968 application was knowingly withheld from the PTO.

2. The Tsai Article

In the course of prosecuting the application that led to the issuance of the '636 patent, SEL disclosed to the PTO as prior art a 1983 article by Dr. Tsai titled "Amorphous Si Prepared in a UHV Plasma Deposition System." This article teaches the reduction of impurities in amorphous silicon to improve performance in electronic devices.

During the prosecution of the '636 patent application, SEL sought to distinguish the Tsai article before the PTO by suggesting that it applied primarily to solar cells rather than to TFT's. Further, SEL argued before the PTO that the Tsai article was distinguishable in that the electrical current in the devices discussed in her article runs in a perpendicular direction, while the electrical current in the TFT's referred to in the '636 patent runs in a parallel direction. At the inequitable conduct hearing, SEL, through the testimony of Dr. Yamazaki, expressed the view that impurities such as carbon and oxygen affect solar cells differently from TFT's and create different problems in the two devices. Thus, SEL asserted both before the PTO and in the course of this hearing, that teachings concerning the effects of impurities in solar cells are not relevant to TFT's.

The record as a whole discloses that SEL's efforts to distinguish the Tsai article before the PTO were neither valid nor accurate. Thus, Dr. Tsai testified convincingly that her article, which refers to "large area devices," would have been understood by those in the field, both at the time of its publication and thereafter, to include devices made with TFT's as well as solar cells. Dr. Fonash agreed, testifying that in 1983 at the time the Tsai article was published, he understood the term "large area device" to include devices

made with TFT's. Dr. Yamazaki also testified that the current active matrix display units that utilize TFT's are large area devices. In sum, the expert testimony convincingly establishes that contrary to SEL's representation to the PTO, the Tsai article would have been understood by persons of ordinary skill in the art in 1983 and thereafter to apply not just to solar cells, but to TFT's as well.

Record evidence reflects that Dr. Yamazaki, a distinguished and accomplished solid state physicist, surely knew this. Thus, his '423 and '488 Japanese laid-open applications, which deal mainly with solar cells, expressly state that the benefits of the lower levels of impurities described in those applications also apply to insulated gate field effect semiconductor device[s]" such as TFT's. So, as the '423 and the '488 laid-open applications reflect, Dr. Yamazaki recognized by 1984 a clear connection between solar cells and TFT's in that the importance of reducing impurity levels is applicable to both. Moreover, SEL was prosecuting the '400 patent application, one of the original patents-in-suit, at approximately the same time it was prosecuting the '636 patent application. The 400 patent, which is also directed mainly to solar cells, contains a figure (figure 9) that illustrates that the invention applies to insulated gate field effect transistors, as well.

In summary for the limited purpose of trying to persuade the examiner that the Tsai article was not material, SEL adopted a position contrary to its own knowledge, and inconsistent with its own previously stated position on an important issue before the PTO. Specifically, in its '423, '488, and '400 patent applications, SEL asserts that its claimed inventions, which are primarily directed to reducing impurities in solar cells, are equally applicable to TFT's. Yet, in its prosecution of the '636 patent application, SEL distinguished the Tsai article on the basis that its teachings apply primarily to solar cells, not TFT's. Thus, contrary to the

clear statements found in the '423, '488, and '400 applications, SEL argued before the PTO, in effect, that references concerned with the effects of impurities in solar cells are not germane to a TFT's patentability. SEL never revealed this inconsistency to the PTO as required under 37 C.F.R. 1.56.

Next, convincing expert testimony also contradicts SEL's representation to the PTO that the Tsai article is distinguishable based on the direction of the current. Thus, Dr. Tsai and Dr. Fonash persuasively testified that it is irrelevant to the effect of impurities in a device as to whether current runs perpendicular or parallel. Accordingly, it is clear from this record that the difference in the direction of current flow was not a valid basis for distinguishing the Tsai article from the '636 patent application. Moreover, Dr. Yamazaki, as an accomplished solid state physicist, was certainly aware that this was a distinction without significance as well.

Knowledge that the teachings of the Tsai article were equally applicable to TFT's was material to the prosecution of the '636 patent application. The expert testimony of Dr. Fonash clearly established that the Tsai article teaches the making of amorphous silicon with impurity concentrations in the amorphous silicon layer within the levels recited in all claims of the '636 patent. The deposition testimony of Dr. Lucovsky confirms this conclusion. Further, as the testimony of Dr. Fonash convincingly establishes, the Tsai article, taken together with the untranslated portions of the Canon '968 application, disclose a device having every element of the [486] asserted claims of the '636 patent.[12] Thus, the clear and convincing evidence demonstrates that the Tsai article, taken

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[12] The Tsai article's materiality to the '636 patent is confirmed by Dr. Yamazaki's own January 1995 letter to his licensing agent, in which he acknowledges the Tsai article as being highly relevant to the '132 patent, which, like the '636 patent, is directed to TFT's, not solar cells.

together with other information, would give rise to a *prima facie* case of unpatentability, and was therefore highly material to the prosecution of the '636 patent application. Equally clear and convincing is that SEL knowingly mischaracterized the article as not relevant to TFT's, the subject matter of the '636 invention.

B. The '132 Application

Samsung asserts that during the prosecution of the '132 patent application, SEL made a material misrepresentation regarding information disclosed in a prior art reference, and additionally failed to disclose at least three material prior art references. Specifically, SEL represented to the PTO that the levels of impurities recited in a prior art reference, U.S. patent No. 4,766,477 issued to Nakagawa ("the Nakagawa '477 patent"), was 4×10^{19} atoms/cm^3 when the correct value was approximately eight times lower. Samsung alleges that SEL deliberately misrepresented the figure in order to distinguish the '636 patent from the Nakagawa '477 patent. Further, Samsung contends that SEL deliberately withheld at least three material prior art references, namely (1) the 1983 Tsai article "Amorphous Si Prepared in a UHV Plasma Deposition System," (2) the '423 laid-open application, and (3) the '488 laid-open application.

A threshold issue is the relevance of any inequitable conduct by SEL in connection with its prosecution of the '132 patent application. Samsung contends that where inequitable conduct is found in an application that results in an issued patent, all subsequent patents relying on the same chain of priority, whether from divisional or continuation applications, must also be held unenforceable, whether or not the applicant's inequitable conduct continued during the subsequent application. Thus, Samsung invites the Court to hold that inequitable conduct during SEL's prosecution of the

'132 patent application necessarily renders unenforceable all the claims of the '636 patent.

This argument requires an extension of existing law. To date, no Federal Circuit case has squarely decided this issue, although there is supporting Federal Circuit dictum, [13] and supporting district court case law, [14] upon which Samsung

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[13] *See Fox Indus., Inc. v. Structural Preservation Sys.*, 922 F.2d 801, 804 (Fed.Cir.1990) (stating that inequitable conduct "early in the prosecution may render unenforceable all claims which eventually issue from the same or a related application"); *see also Consolidated Aluminum*, 910 F.2d at 810-11 (inequitable conduct in procuring one patent-in-suit may render related patents-in-suit unenforceable where the inequitable conduct has an "immediate and necessary relation" to the equity patentee seeks, namely enforcement of the related patents).

[14] *See Baxter Int'l. Inc. v. McGaw, Inc.*, 958 F.Supp. 1313, 1315—17 (N.D.Ill.1997) (Inequitable conduct in original application which gave rise to multiple divisional applications resulted in all three resulting patents being held unenforceable, even when inequitable conduct did not affect the claims of one of the resulting patents); *Jack Frost Lab., Inc. v. Physicians & Nurses Mfg. Corp., 901 F.Supp. 718 729 (S.D.N.Y. 1995)* Inequitable conduct in original application that resulted in issued patent also made later patent resulting from continuation application unenforceable); *Golden Valley Microwave Foods, Inc. v. Weaver Popcorn Co., Inc.*, 837 F.Supp. 1444, 1478 (N.D.Ind.1992) (Inequitable conduct in prosecution of original application that resulted in issued patent could not be purged in continuation application, and therefore, subsequent patent in the same chain held unenforceable); *Molins PLC v. Textron, Inc.*, 821 F.Supp. 1551, 1581 (D.Del.1992) *aff'd*, 48 F.3d 1172, 1187 (Fed.Cir. 1995) (Inequitable conduct in original application that resulted in an issued patent likewise rendered later patent issued from a divisional application unenforceable); *East Chicago Mach. Tool Corp. v. Stone Container Corp.*, 181 U.S.P.Q. 744, 748 (N.D.Ill.1974), *vacated in part*, 185 U.S.P.Q. 210 (N.D.Ill. 1974) (Where inequitable conduct was committed in the original application, all patents stemming from it, whether resulting from continuation or divisional applications, are unenforceable for inequitable conduct regardless of whether the inequitable conduct relates to any of the issued claims in the subsequent patents).

Closely read, none of these cases is precisely on point factually; none involves, as here, misrepresentations or nondisclosure made with respect

relies. In the [487] final analysis, however, this issue need not be reached, as SEL's inequitable conduct during its prosecution of the '636 patent application is sufficient to render the claims of the '636 patent unenforceable. Nevertheless, given the close relationship between the '636 and the '132 patents,[15] any inequitable conduct by SEL during its prosecution of the '132 is still relevant to show plan, motive, intent and pattern and practice under Rules 402, 403, & 404(b), Fed.R.Evid.[16]

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to an earlier patent in a chain, but not repeated in connection with the later challenged patent in the chain. Instead, the cited cases generally involve misconduct with respect to an earlier patent that is repeated and hence permeates. In a sense, the prosecution of the later, elated patent, *See*, e.g., *Jack Frost*, 901 F.Supp. at 718; *Golden Valley*. 837 F.Supp. at 1444; *but cf. Baxter*, 958 F.Supp. at 1315-1318 inequitable conduct committed during original application not repeated during prosecution of subsequent, divisional application).

[15] Again, the '636 patent resulted from continuation and divisional applications from the application that issued as the 132 patent. See appendix. Because the subject matter of the two patents is so closely related, a terminal disclaimer was filed, giving the 636 patent the expiration date of the '132 patent.

[16] It is worth emphasizing the distinction drawn here between relying on inequitable conduct relating to the '132 patent as an independent basis for holding the '636 patent unenforceable which is not the course followed here, and relying on inequitable conduct relating to the '132 patent as evidence that may aid in the determination of SEL's intent with respect to conduct relating to the prosecution of the '636 patent application. The latter course is followed here. In other words, this Memorandum Opinion proceeds on the basis that conduct related to the prosecution the '636 is the sole basis for a finding of inequitable conduct, but that conduct relating to the '132 is relevant and probative as it provides important context, given the close relation of the patents and as it sheds light on the intent underlying the conduct relating to the prosecution of the 636 patent.

A further digression on this subject is warranted. Although there do not appear to be any Federal Circuit decisions involving or applying Rule 404(b), Fed.R.Evid., there can be little doubt that it is as applicable in patent litigation as in other litigation contexts. See Arcade, Inc. v. Minnesota Mining and Mfg. Co., 24 U.S.P.Q.2d 1578, 1589 (E.D.Tenn.

1. The Nakagawa '477 Patent

During SEL's prosecution of the '132 patent application, the PTO originally rejected some of its claims relating to low levels of impurities based on the same or similar impurity levels described in the Nakagawa '477 application. In response, SEL, in an amendment filed on May 25, 1993. argued that the rejected '132 claims should be allowed over the Nakagawa application because the '132 claimed a lower level of impurities. To prove this vital point, the amendment submitted to the PTO included a calculation premised on an incorrect, overstated figure for the atomic density of amorphous silicon. Specifically, the figure used was 4×10^{23} atoms/cm^3, which was approximately eight times higher than the correct value of 5×10^{22} atoms/cm^3. The result of using this artificially inflated figure was that SEL's calculation of the level of impurities disclosed in the Nakagawa '477 patent, 4×10^{19} atoms/cm^3 was also approximately eight times higher than the figure actually disclosed in the Nakagawa '477 patent. Thus, the impurities range claimed in the '132 patent, namely 5×10^{18} atoms/cm^3 or less, appeared lower than that disclosed and claimed in the Nakagawa '477 patent. On this basis, the examiner allowed the previously rejected claims in the '132 patent over the Nakagawa reference.

1991) (finding prior inequitable conduct to he 404(b) evidence from which to infer intent to deceive during later patent prosecutions). Yet, because the inequitable conduct defense is so often frivolously pied, *see Burlington Indus., Inc. v. Davco Corp.*, 849 F.2d. 1418, 1422 (Fed.Cir. 1988) (characterizing the practice of charging inequitable conduct in almost every patent case as "an absolute plague"), district courts must take care to ensure that assertions of the defense of inequitable conduct plus reliance on Rule 404(b) do not become a license for a fishing expedition into a patentee's files concerning related patents and applications. Discovery of such files should not be allowed absent a significant threshold showing of inequitable conduct and relevance with respect to the patent-in-suit.

Dr. Yamazaki testified that the incorrect silicon atomic density figure provided to the PTO was the result of a careless error by Mr. Kunitaka Yamamoto, SEL's in-house patent representative who was assisting Dr. Yamazaki with the '132 prosecution. Mr. Yamamoto confirmed in his testimony that he had made the error. Yet, no satisfactory explanation was provided by Mr. Yamamoto as to how he arrived at this incorrect figure, [488] or why he was able to provide the correct atomic density figure for silicon in later applications.[17] Mr. Yamamoto merely testified that the mistake occurred because his "memory of the number of [silicon] atoms was incorrect."

Dr. Yamazaki gave conflicting testimony on precisely how he learned of the error. At one point during the hearing, Dr. Yamazaki testified that I.B.M. had pointed out the mistake sometime following a March 1995 licensing meeting. Later, Dr. Yamazaki testified that I.B.M. had not revealed the mistake, but rather that he had discovered the error while preparing for this lawsuit. In any event, it is clear that neither Dr. Yamazaki nor Mr. Yamamoto informed the PTO that an error had been made regarding the silicon density figure provided in connection with the prosecution of the '132 patent. Specifically, Dr. Yamazaki testified that he did not disclose the error when it came to his attention because the '132 patent had already issued. Rather, he thought that it was sufficient that the correct figure had been submitted in connection with SEL's pending prosecution of the '636 patent application.[18] Mr. Yamamoto also testified that he did not

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[17] Specifically, SEL used the correct atomic density figure for amorphous silicon in an April 1995 filing to the PTO in connection with the '636 proceeding, and again later in the same proceeding in a November 15, 1995 filing.

[18] On this point, it is worth noting that Mr. Yamamoto testified that Dr. Yamazaki suggested calling the error to the PTO's attention, but that he, Mr. Yamamoto, essentially vetoed this suggestion. This testimony is flatly

think that he had any obligation to inform the PTO that an error had been made during the prosecution of the then issued '132 patent.[19]

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implausible; the record leaves no doubt that Dr. Yamazaki pays close attention to matters of this sort, and that in all matters relating to his patent applications, Dr. Yamazaki ultimately calls the shots. This fact is made pellucidly clear by Samsung's Exhibit No. 1417, a January 1996 letter from Dr. Yamazaki to his licensing agent explaining Dr. Yamazaki's decision to revoke a power of attorney in connection with the prosecution of Application No. 425,455, an application in the '250 application-'132-'636 chain. See appendix. There, Dr. Yamazaki writes:

> The Revocation was necessary because our view regarding certain prior art references was entirely different from Mr. Ferguson's [SEL's patent attorney] view. That is, after we received a Notice of Allowance, Mr. Ferguson suggested that it was necessary to submit the references to the Patent Office as a duty of disclosure. To do this, a Rule 62 continuation application was necessary. However, contrary to Mr. Ferguson, it was our belief that these references were not more material than the references cited during the prosecution. We and Mr. Ferguson extensively discussed this matter but could not finally reach a conclusion. Mr. Ferguson suggested that even though we (SEL) believed that these references were immaterial, he himself had an obligation to disclose the references as a patent attorney since he believed the references were more relevant than the prior art considered by examiners. In view of the above situation, we decided to file the Revocation of Power of Attorney in order to allow the application to issue as a patent.

There is no doubt, then, that it is Dr. Yamazaki who ultimately determines what information is disclosed to the PTO in connection with his patent applications.

[19] In this regard, Mr. Yamamoto testified that he had read pertinent portions of the Code of Federal regulations and the PTO's Manual of Patent Examining Procedure and understood his duty of candor to the PTO. More specifically, he confirmed his understanding of the duty of candor as encompassing a duty to disclose to the FF0 material information resulting from Japanese patent proceedings, including any material prior art or information cited or brought to his attention in any related foreign application.

The expert testimony of Dr. Fonash established by clear and convincing evidence that disclosure of the correct figure for the density of silicon was highly material to the prosecution of the '132 patent application. Specifically, the PTO originally rejected claims in the '132 patent application based in part on the impurity concentrations disclosed in the Nakagawa '477 application. Yet, as Dr. Fonash testified, the use of an overstated silicon atomic density figure enabled SEL to argue that the '132 patent application claimed a lower level of impurities than the Nakagawa '477 application. Disclosure of the correct silicon atomic density figure, then, would have deprived SEL of this important argument in support of patentability.

2. The Tsai Article[20]

On August 26, 1983, Dr. Yamazaki attended a lecture given by Dr. C.C. Tsai at a [489] technical conference in Tokyo. The lecture dealt with depositing amorphous silicon films with specific low levels of impurities. Significantly, these low impurity levels also fall within the claim limitations of the '132 and the '636 patents. Dr. Yamazaki testified that his work on lowering impurity levels preceded Dr. Tsai's speech, and that he had given a similar speech concerning his own work in reducing levels of impurities at a Reston, Virginia conference in May 1983. He initially testified that he does not remember being particularly impressed with the Tsai speech, given that it followed his own on reducing impurities.[21] He continued that he did not really recall

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[20] This is the same article that SEL mischaracterized as limited to solar cells in connection with its prosecution of the '636 patent application *See supra* Part III(A)(2)

[21] Yet, in a later appearance on the witness' stand, Dr. Yamazaki admitted that Dr. Tsai's presentation at the 1983 Tokyo conference "left an impression" on him because it was a large conference and Dr. Tsai was one of the few women speaker there.

anything in particular about Dr. Tsai's speech, including whether she discussed specific impurity levels. This testimony was not in accord with his testimony at a February 27, 1998 deposition, at which time he characterized his initial impression of Dr. Tsai's speech as being "spectacular." Other experts, including Dr. Meyerson, confirmed that the Tsai article was a path breaking work of great importance.

At the time of the conference, Dr. Yamazaki received an abstract of Dr. Tsai's lecture. Dr. Tsai also testified that she spoke with Dr. Yamazaki following her lecture, and that he asked her for a copy of "Amorphous Si Prepared in a UHV Plasma Deposition System," the article on which her lecture had been based. The Tsai article was in fact published later that year in the Journal of Non-Crystalline Solids, Volume 59 & 60 (1983). Dr. Tsai stated that she directed her secretary to send Dr. Yamazaki a reprint of the article and that it was accordingly sent to him. Further, Dr. Tsai stated that all conference attendees, including Dr. Yamazaki were sent a copy of all conference papers in a bound volume.

During his first appearance at the hearing Dr. Yamazaki testified that he did not recall having a conversation with Dr. Tsai, or requesting a copy of her article at the August 1983 conference. Rather, he only remembered speaking to her for the first time, apparently on an unrelated matter, one year later at a conference in Snowbird, Utah. Further, Dr. Yamazaki testified that he did not remember receiving anything other than the abstract of her speech.[22]

In 1984, Dr. Yamazaki and others submitted an article, also to the Journal of Non Crystalline Solids, which was published later that year. The 1984 Yamazaki article cites to a 1984 article written by Dr. Tsai, which in turn references her 1983 article, "Amorphous Si Prepared in a UHV Plasma

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[22] The abstract alone does not discuss specific impurity levels.

Deposition System." Dr. Yamazaki testified that the portion of his 1984 article that refers to the Tsai publication was written by a co-author, and that he in fact never read the Tsai reference.

Given the sequence of events, and the record as a whole, Dr. Yamazaki's testimony on the Tsai article is neither plausible nor credible. It is simply implausible that Dr. Yamazaki did not review and comprehend the significance of the Tsai article in 1983-4 and thereafter. He testified that he delivered a similar speech on lowering impurities just months before he heard Dr. Tsai's own presentation, a presentation Dr. Yamazaki once described as "spectacular," an assessment consistent with Dr. Meyerson's and Dr. Fonash's. but inconsistent with his (Dr. Yamazaki's) own hearing testimony. Further, Dr. Tsai distinctly remembers speaking with Dr. Yamazaki following her presentation, and granting his request for a reprint of her article. And, Dr. Yamazaki's own 1984 article, although a collaborative work, specifically cites to a Tsai article which itself references her 1983 article. Dr. Yamazaki, as an accomplished physicist with a focused interest in this area and as an experienced inventor with a demonstrated interest in securing patents, had every reason to review and remember Dr. Tsai's article.

Yet, the 1983 Tsai article was not disclosed as prior art during the prosecution [490] the '132 patent. Rather, SEL first disclosed the Tsai article to the PTO in November 1994 in connection with Application No. 214, '494 ("the '494 application"), which was soon thereafter abandoned.[23] At that time, SEL represented to the PTO that the Tsai article had only recently come to its attention. Similarly, Dr. Yamazaki testified at the inequitable conduct hearing that the Tsai article was first called to his attention as relevant prior art to

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[23] See appendix. The Tsai article was also disclosed to the PTO on June 7, 1995 during the prosecution of the '636 patent application.

the '132 patent during licensing negotiations with Toshiba in October, 1994, after the '132 patent had issued. Yet, as already noted, this is simply not credible; the record as a whole reflects that Dr. Yamazaki was well aware of the Tsai article throughout the relevant period.

As was true in the prosecution of the '636 patent, the Tsai article was highly material to the '132 patent application. In a January 1995 letter to his licensing agent for the '132 patent, Dr. Yamazaki himself stated that "we do not think there is a more relevant reference than C.C. Tsai's abstract of August 22, 1983 and his (sic) papers of December 1983, that you know." Despite the admission, Dr. Yamazaki testified at the hearing that the abstract is not in fact relevant. Yet, any attempt by Dr. Yamazaki to rely on a distinction between the abstract and the entire article is unpersuasive. The record as a whole leaves the Court with a clear conviction that Dr. Yamazaki was well aware of the Tsai article throughout the relevant period. And, expert testimony established by clear and convincing evidence that the 1983 Tsai article was highly material. Specifically, Tsai's article teaches the making of amorphous silicon with impurity concentrations in the amorphous silicon layer within the levels recited in all claims of the '132 patent. Dr. Fonash also testified that the Tsai article shows "you in great depth, in greater detail, how to attain those impurity levels, and has data showing how they actually did attain those impurity levels." He further testified that the Tsai article is directed to "large area device applications" which include TFT's.

Claim 7 of the '132 patent is directed to a TFT with low impurities. Accordingly, the evidence clearly and convincingly shows that disclosure of the Tsai article during the prosecution of the '132 patent would have given rise to a *prima facie* case of unpatentability.

3. The '423 and '488 Laid-open Applications

Dr. Yamazaki is the sole inventor on the '423 and the '488 Japanese laid-open applications, which were filed in 1982 and published by the Japanese patent office in 1984. Neither reference was disclosed to the PTO during the prosecution of the '132 patent. The '423 and the '488 laid-open applications have very similar disclosures. The '423 and the '488 are directed to solar cell technology, and specifically to the efficiencies to be achieved in photoelectric devices from low levels of impurities. Both laid-open applications conclude, however, that the "present invention is also effective for an insulated gate field effect semiconductor device having an NIN junction *(i.e.,* a junction comprising, in this order, a source or drain, a channel forming region, and a source or drain) or a PIP junction, as well as for a transistor having an NIPIN or a PINIP junction." [24] It is clear, therefore, that Dr. Yamazaki himself knew and believed that the '423 and '488 laid-open applications, though directed to solar cells, were also pertinent to TFT's.

Yet, Dr. Yamazaki testified during the hearing that he forgot that the '423 and '488 applications taught lowering impurities in insulated gate field effect semiconductor devices, and therefore he did not disclose them to the PTO in connection with the '132 patent prosecution. Specifically, he testified that because the '423 and the '488 dealt chiefly with solar cells, he thought that neither had any relevance to the '132 patent application. This contention is belied by the terms of the '423 and the '488 applications themselves, and by the convincing expert testimony of Dr. Tsai and Dr. Fonash. Most tellingly, though, Dr. Yamazaki's contention is flatly

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[24] Indeed, the claims of the '423 are not limited to solar cells, but also claim semiconductor devices. Also worth noting is that the prosecution application was protracted, extending from 1982 to a rejection on appeal in 1992.

refuted by the fact that SEL referenced other works directed primarily to solar cells during its prosecution of the '132 patent, including one of Dr. Yamazaki's own U.S. solar cells patents, U.S. Patent. No. 4,239,554, and an article by Magee and Carlson in a publication called "Solar Cells." Even if Dr. Yamazaki's testimony that he forgot about the specific passages contained in the '423 and the '488 applications describing their relevance to TFT's were plausible, it is not plausible that he forgot the scientific principle underlying those passages, *i.e.*, that the importance of reducing impurity levels is germane to both solar cells and TFT's.

Dr. Yamazaki also testified that he first became aware of the significance of the '423 and the '488 through a rejection by the Japanese patent office in his corresponding '250 application.[25] The rejection, mailed on October 19, 1994, was based in part on the disclosures in Dr. Yamazaki's '423 laid-open application. Further, Dr. Yamazaki remembered Toshiba representatives suggesting, during licensing negotiations in October 1994, that the '423 and '488 applications were prior art to the '132 patent. Dr. Yamazaki testified that he then looked into the matter. Significantly, Dr. Yamazaki thereafter, in January 1995, told his licensing agent that he considered the '423 and the '488 references to be more material to the '132 patent than other references already disclosed to the PTO. Tellingly, he further instructed his licensing agent not to disclose the '423 and the '488 laid-open

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[25] Although Dr. Yamazaki initially testified that he learned in 1992 that the '250 had been rejected in part because of the '423 laid-open application, he later clarified that it was not until 1994 that the '423 application was cited as a basis for the rejection. Had Dr. Yamazaki discovered in 1992 that the '423 was a basis on which his '250 application had been rejected, he would have been immediately placed on notice of his duty to disclose the '423 in connection with his pending 132 patent application. As Dr. Yamazaki testified, the Japanese '250 application has One-to-one relationship with both the '132 one the '636 patents.

applications to I.B.M., a prospective licensee.[26] This ploy failed as during his licensing meeting with I.B.M. in March 1995, I.B.M. representatives specifically called attention to the fact that Dr. Yamazaki had failed to disclose the '423 and '488 applications to the PTO as prior art in the '132 proceeding. Following the meeting with I.B.M. Dr. Yamazaki submitted the references to the PTO on April 20, 1995 in connection with the continuation application of the '494 application. Dr. Yamazaki also submitted the '423 and the '488 references to the PTO on June 7, 1995, in connection with the '636 patent application.

The materiality of the '423 and the '488 laid-open applications to the prosecution of the '132 application is pellucidly clear. Dr. Fonash convincingly testified that the elements in claim 7 of the '132 patent are taught in the '488 and the '423 laid open applications. The disclosures in the '423 were in fact, part of the basis on which the Japanese patent office had earlier rejected the corresponding '250 application. Thus, disclosure of the '423 and the '488 laid open applications during the '132 prosecution would have given rise to a prima facie case of unpatentability. They were highly material prior art.

C. Additional Omissions During the '132 and the '636 Patent Applications

Samsung, during the inequitable conduct hearing, alleged two additional instances of material withholdings by SEL

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[26] Specifically, in a January 1995 letter, Dr. Yamazaki instructed his licensing agent that:

> We think SEL's laid-open applications indicated in our letter of January 10, 1995 would be more relevant than any other materials. Please be careful not to disclose these laid-open applications to I.B.M.

during the '132 and the '636 patent applications.[27] First Samsung claims that SEL deliberately failed to disclose as prior art Japanese Patent No. 58-2073 issued to Sony ("the Sony '2073 patent"), even though it was aware that the Sony '2073 patent was a basis on which the Japanese patent office ejected its corresponding '250 patent application. Second, Samsung contends that SEL deliberately failed to disclose the materials [492] produced in connection with Dr. Yamazaki's 1983 Reston Virginia speech, even though these materials discuss the importance of low levels of impurities in electronic devices.

1. The Sony '2073

Dr. Yamazaki testified that in 1992, when he originally received the rejection of the '250 Japanese laid-open application, the Sony '2073 was cited as one basis for the rejection.[28] Mr. Yamamoto, who also learned of the basis for the '250 rejection in 1992, thus initially instructed SEL's patent attorney to disclose the Sony '2073 reference to the PTO in connection with an application within the '250 application-'132-'636 chain.[29] Inexplicably, SEL later instructed its patent attorney to file an Information Disclosure Statement ("IDS") in connection with the application that omitted the Sony '2073 reference. The '250 application was finally rejected by the Japanese patent office in October 1994 based on the disclosures in the Sony '2073 and Dr.

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[27] These additional allegations of inequitable conduct were raised for the first time at the hearing. Accordingly, the evidence adduced concerning these allegations is considered for the limited purpose of ascertaining SEL's motive, plan, and intent with respect to the '636 patent. See Rules 402, 403, 404(b), Fed. R. Evid.

[28] The Japanese patent office later cited to the '423 laid-open application as an additional basis for rejection.

[29] Specifically, this was Application No. 885,643, which was filed on May 19, 1992, and which was later abandoned. *See* appendix.

Yamazaki's own '423 laid-open application. Yet, the Sony '2073 was not disclosed as prior art during the prosecutions of the '132 or the '636 patents. And significantly, the Sony '2073 patent was not a reference that was asserted against SEL by a prospective licensee, as were the Tsai article and the '423 and '488 applications that were eventually cited to the PTO by SEL in the '636 proceeding, but omitted from the '132 proceeding.

Thus, by 1992, SEL was aware that the '250 application, which Dr. Yamazaki conceded has a "one-to-one" relationship with both the '132 and the '636 patents,[30] had been rejected by the Japanese patent office based in part on the Sony '2073 patent. Yet, it failed to disclose the reference to the PTO despite the specific admonitions found in Rule 56.[31] Further, Dr. Fonash testified that the Sony '2073 combined with the '423 application rendered obvious every element of Claim 1 of the '132 patent. Thus, the Sony '2073 was clearly a highly material reference that came to the attention of Dr. Yamazaki during the '132 application and well before the prosecution of the '636 application.

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[30] Both of which also rely on the '250 application for priority stemming from the '250 application's May 1984 filing date. This, of course, is significant in assessing the patentability of the invention claimed in the '132 and '636 patents.

[31] In connection with an applicant's duty to disclose all information known to be material to patentability, 37 C.F.R. § 1.56 specifically "encourages" applicants to examine

> (1) Prior art cited in search reports of a foreign patent office in a counterpart application, and
>
> (2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentability defines, to make sure that any material information contained therein is disclosed to the Office.

2. The Reston Materials

Dr. Yamazaki testified that his May 1983 speech in Reston, Virginia concerned the development of low impurity levels in the semi conductor layer. The speech was thus antecedent to, and concerned the same subject matter as, the August 1983 Tsai speech. Notably, Dr. Yamazaki conceded that the speech and related materials disclose the importance of low levels of impurities and "would be important" on this issue. An abstract from Dr. Yamazaki's speech was published, and he eventually published a full paper in the Journal of Non-Crystalline Solids. SEL did not disclose any of these materials to the PTO during its prosecution of either the '132 or the '636 patent applications. And significantly, unlike the references disclosed in the '636 proceeding but not in the '132 proceeding,[32] none of these materials was asserted against SEL by a prospective licensee in the course of licensing negotiations on these patents.

Dr. Yamazaki gave inconsistent testimony with regard to the materiality of his Reston speech and materials. He initially testified at the hearing that he only became aware of [493] the importance of the Reston materials during the Spring of 1996, and even then, only considered them to be important with regard to the '204 patent. Dr. Yamazaki testified that he did not submit the materials to the PTO because the '204 patent had issued prior to the Spring of 1996. Later, however, Dr. Yamazaki seemed to retreat from this position, stating that he did not understand the Reston materials to be prior art, even with regard to the '204 patent. Further, Dr. Yamazaki stated that his discussion at Reston was in fact cumulative of other references cited during the '636 prosecution. Yet, Dr. Yamazaki also stated, inconsistently, that the one-page abstract from his Reston speech did not overlap with other references cited. In any

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[32] Such as the Tsai article and the '423 and '488 laid open applications.

event, the record is inconclusive on whether the Reston speech was material prior art.

D. The '204 Patent Application

Samsung alleges two instances of inequitable conduct by SEL during its prosecution of the '204 patent. First, Samsung contends that SEL deliberately withheld reliable test results which conclusively established that prior art devices attained lower impurity levels than those claimed in the '204 patent. Second, Samsung contends that SEL knowingly overstated the efficiency levels achieved in the '204 patent in arguing for patentability.

Again, the threshold issue is the relevance of any inequitable conduct by SEL in connection with its prosecution of the '204 patent. And, in this regard, it is significant that the '204 patent is not a part of the '250 application-'132-'636 chain. Samsung contends, however, that where inequitable conduct is found in an application that results in an issued patent, that misconduct may render a closely related patent-in-suit unenforceable. This contention is an application of what is sometimes referred to as the "infectious unenforceability" doctrine. Relying on this doctrine, Samsung contends that because the '204 patent and the '636 patent have a common inventor, common owner, similar prior art references, and a similar subject matter (*i. e.*, inventions relating to low impurity levels), inequitable conduct during the prosecution of the '204 patent may be sufficient to render the '626 patent unenforceable.

This argument like Samsung's argument in connection with the '132 patent, also requires an extension of existing law. To date, no Federal Circuit decision has applied the infectious unenforceability doctrine based solely upon such commonalities. *See Consolidated Aluminum*, 910 F.2d at 812 (infectious unenforceability applied where inequitable

conduct during prosecution of one patent "permeated the prosecution of the other" patents-in-suit).[33] And, because SEL's inequitable conduct during its prosecution of the '636 patent application is sufficient to render the claims of the '636 patent unenforceable, this issue need not be reached.

Moreover, the alleged misconduct during the prosecution of the '204 patent is too remote from the patent-in-suit to be probative of SEL's plan, motive, intent and pattern and practice with regard to the '636 patent. *See* Fed.R Evid. 402. 403, & 404(b). The information allegedly withheld and mischaracterized during the prosecution of the 204 patent is not information that was material to the prosecution of the '636 patent. And, there is no suggestion that the alleged misconduct was connected to, or of consequence, during SEL's subsequent prosecution of the '636 patent. Thus, Samsung has failed to establish the relevance of the alleged misconduct with respect to the patent-in-suit.

IV.

It is clear that SEL knowingly made several highly material withholdings and [494] mischaracterizations during the prosecution of its '132 and '636 patent applications. The issue of intent remains. And in this regard, it is worth restating that

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[33] In *Consolidated Aluminum*, the Federal Circuit found that the patentee's inequitable conduct during the prosecution of one patent enabled it to make "argument[s] it could not have made" in prosecuting the applications that became the other patents-in-suit. 910 F.2d at 811. Therefore, the patentee's misconduct "permeated the prosecution of the other patents-in-suit. *id.* at 812. On this basis, the court held that the inequitable conduct in prosecuting the one patent had the "immediate and necessary relation" to the equity sought by the patentee, namely the enforcement of the other patents-in-suit, to render them similarly unenforceable. *Id.* at 811-812. In the instant case, there is no such relation between the alleged misconduct during the prosecution of the '204 patent and the sought after enforcement of the '636 patent.

the "materiality of an undisclosed reference does not presume an intent to deceive." *Halliburton*, 925 F.2d 1435. Yet, where, as here, a patentee faces a "high level of materiality and clear proof that it knew or should have known of that materiality, it can expect to find it difficult to establish 'subjective good faith' sufficient to prevent the drawing of an inference of intent to mislead." *Critikon*, 120 F.3d at 1257. In such circumstances, a "mere denial of intent to mislead (which would defeat every effort to establish inequitable conduct) will not suffice." *Id.* In the final analysis, intent is a judgment that must be made on the totality of the circumstances; courts must determine whether an applicant's conduct, when "viewed in light of all the evidence, including evidence indicative of good faith, . . . is culpable enough to require a finding of intent to deceive." *Halliburton*, 925 F.2d at 1443.

In the instant case, a review of the record as a whole points clearly and convincingly to the conclusion that SEL's conduct before the PTO with regard to the '636 is sufficiently culpable to warrant a finding of intent to deceive. The evidence clearly reveals that Dr. Yamazaki is an accomplished inventor who is intimately involved in the prosecution of his patent applications. As he testified, "patents are my life. They are very important to me." Securing a patent on the '636, given its revenue generating potential, was particularly important to Dr. Yamazaki and his company. In pursuit of this goal, the evidence shows clearly that Dr. Yamazaki compromised his fundamental duty of candor to the PTO.

Thus, SEL submitted to the PTO a full Japanese language version of the Canon '968 application, but only a one-page partial English translation. The partially translated portion of Canon disclosed only one of the elements of the asserted claims in the '636 application, the silicon nitride gate insulator. Further, SEL identified the relevance of the Canon '968 application to the PTO only as "disclos[ing] the use of

silicon nitride for a gate insulating layer of a thin film transistor." Yet, clear and convincing expert testimony established that the untranslated portions of the Canon '968 application disclosed other elements of the structure found in the '636 patent; *i.e.* the same intrinsic semi conductor layer, the same sandwich structure, and the admonition to avoid impurities. The Canon '968 thus contained the most complete combination of the elements[34] described in the '636 patent. These same elements, such as the limitation of an intrinsic semiconductor layer, were used by SEL to distinguish the '636 patent application from prior art. And, given that Dr. Yamazaki decided to submit just a partial translation of Canon, it is simply not credible that Dr. Yamazaki was unaware that the untranslated portions of the Canon '968 application disclosed the additional elements described in his '636 patent application. These elements, of course, formed a basis for SEL's patentability argument.

SEL contends that its decision to provide the PTO with a full Japanese language version of the Canon '968 application and a partial English translation along with 90 other references of prior art, is indicative of its good faith compliance with the duty to disclose. Yet, far more plausible, on this record, is that SEL's submission of a partial translation was an effort to conceal from the PTO the full importance of the Canon '968 application; *i.e.*, that it disclosed the same structure found in the '636 patent, and not merely one of its elements. While SEL correctly notes that the patent examiner could have secured a full translation from within the PTO,[35] SEL's brief statement of relevance identifying only the silicon nitride gate as pertinent, coupled with the partial translation disclosing that element, certainly removed any incentive to do so. Thus, the evidence points

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[34] That is, in addition to the silicon nitride gate insulator.

[35] See Manual of Patent Examining Procedure § 901.05(d).

clearly and convincingly to the conclusion that (1) SEL knew that a full translation of Canon, which disclosed the same TFT structure as described in the '636, would decrease the likelihood of the '636 patent being issued, and (2) it knowingly concealed the full importance of the Canon '968 reference in an effort to mislead the PTO.

SEL also disclosed to the PTO the Tsai article, which, as expert testimony clearly and convincingly established, is highly material to the subject matter of the '636 patent, as it teaches the making of amorphous silicon with impurity concentrations within the levels recited in all claims of the '636 patent. Also clear from the record is that SEL's efforts to distinguish the Tsai article, based on it's application primarily to solar cells and on the perpendicular direction of the current flow, were not only invalid, but also inconsistent with its own position on the subject. Thus, in a January 1995 letter to his licensing agent for the '132 patent, Dr. Yamazaki concedes that "we do not think there is a more relevant reference than C.C. Tsai's abstract of August 22, 1983 and his (sic) papers of December, 1983." In his '423 and '488 laid-open applications and his '400 patent application, Dr. Yamazaki clearly recognized that inventions directed to low levels of impurities in solar cells are highly relevant to TFT's. Moreover, SEL's argument before the PTO is flatly belied by the fact that in this very infringement action, SEL originally asserted two patents against Samsung that are directed mainly to low levels of impurities in solar cells, the '204 and the '400 patents. Thus, the record points clearly and convincingly to the conclusion that in distinguishing the Tsai article before the PTO, SEL knowingly advanced a meritless argument in an effort to mislead the PTO.[36]

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[36] It is worth noting that advocacy before the PTO is appropriate. But, there is a line between legitimate advocacy in accordance with the duty of candor, and advocacy that the applicant surely knows has a propensity to mislead the examiner. Here, that line was crossed.

Moreover, SEL's motive for engaging in such conduct is illuminated by Dr. Yamazaki's testimony of why, following the issuance of the '132 patent, he felt compelled to file the application which led to '636 patent. In essence, Dr. Yamazaki testified that he knew, after meeting with several prospective licensees who called attention to SEL's withholdings during the '132 prosecution, that his potentially lucrative patent was vulnerable. To remedy this problem, he decided not to seek reissue of the '132 patent,[37] but to pursue a new patent on the same invention that would be immune from the problems that infected the '132 patent. Thus, SEL filed and pursued the '636 patent. In doing so, SEL was not required to surrender the '132 patent or to disclose the specific errors that were made in connection with the prosecution of that patent.[38]

Yet, SEL still had to avoid the prior art references that it was now forced to disclose to the PTO, such as the Tsai article and the '423 and the '488 applications. Thus, SEL mischaracterized the Tsai article as applying primarily to solar cells. Further, as Dr. Yamazaki testified, SEL had to limit the claims of the '132 patent.[39] Specifically, the '636 patent is limited to an IGFET with a *silicon nitride* gate, and an *intrinsic* silicon layer, and a *sandwich* structure in the

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[37] Reissue is the well-established procedure available to patentees who have inadvertently and without any deceptive intention made errors before the PTO. This procedure first requires surrender of the patent at issue as well as a specification of errors or omissions previously made. *See* 35 U.S.C. § 251.

[38] Note, however, that the result reached here does not depend in any way on SEL's decision not to surrender and seek reissue of the '132 patent, nor does this decision suggest that SEL had a duty to do so.

[39] Specifically, when asked why he limited the claims of the '636, Dr. Yamazaki testified that "there were these various references. These references were to be avoided, but I don't believe that the essential nature of the invention also [was] changed."

channel region, while the claims in the '132 patent are not so limited. Of all the references cited to the PTO in connection with the '636 patent application, only the Canon '968 application describes a TFT containing each of these three elements. Clearly, then, the Canon '968 was a highly material reference to the '636 patent application, which posed a significant threat to rendering the '636 unpatentable. It is simply implausible, under the circumstances, that SEL was not aware of this fact. Rather, the evidence points clearly and convincingly to the conclusion [496] that SEL's awareness of this fact motivated its decision to submit just the partial English translation in an effort to hide material information.

Finally, when viewed in conjunction with SEL's conduct during the prosecution of the '132 patent application, the record as a whole reflects a clear pattern and practice of initial nondisclosure, followed by incremental disclosure only when compelled by the circumstances to do so, followed, at times, by mischaracterization. Thus, SEL intentionally withheld four material prior art references; the Tsai article, the '423 and the '488 laid-open applications, and the Sony '2073 patent. The record as a whole points clearly and convincingly to the fact that SEL knew of these materials during the pertinent period. Yet, SEL disclosed the references to the PTO only when forced to do so by a prospective licensee. Thus, the Tsai article and the '423 and '488 applications were cited to the PTO only after these matters were asserted by prospective American licensees during negotiations, whereas the Sony '2073, which was called to SEL's attention by the Japanese patent office and not a potential licensee, was never disclosed to the PTO.

And, after receiving an initial rejection of the '132 patent based on the impurity levels in the Nakagawa '477 patent, SEL submitted to the PTO an amendment which erroneously calculated the level of impurities disclosed in the Nakagawa '477 patent as 4×10^{19} at oms/cm^3. The error, for which no

satisfactory explanation was provided, conveniently provided SEL with a basis from which to overcome the Nakagawa '477 patent. And when prosecuting the '636 patent application, the patentability of which was dependant on its specific limitations combined with its impurity levels, SEL concealed the importance of the Canon '968 application and disingenuously distinguished Tsai.

The evidence demonstrates a sophisticated, subtle, and consistent effort to hide the ball from the PTO in a manner plainly at odds with an applicant's duty of candor, good faith, and honesty. The record, as a whole, simply contains too many instances of information withheld, and references mischaracterized, to reach any conclusion other than that the withholding and mischaracterizations were part of an intentional, not accidental or inadvertent, plan to mislead the PTO.

V.

During its prosecution of the '636 patent application, SEL knowingly made two highly material withholdings and/or mischaracterizations. The prior art references withheld and/or mischaracterized were not trivial, but rather were central to the essential question of patentability. The evidence points clearly and convincingly to the conclusion that this conduct was performed with the intent to deceive the PTO. Consideration of *SEL's* conduct in connection with the prosecution of the '132 patent only bolsters this conclusion. Thus, SEL engaged in inequitable conduct during the prosecution of the '636 patent, and accordingly, the entire patent is unenforceable.

For the foregoing reasons, SEL's patent infringement suit against Samsung must be dismissed with prejudice.

An appropriate order shall issue.

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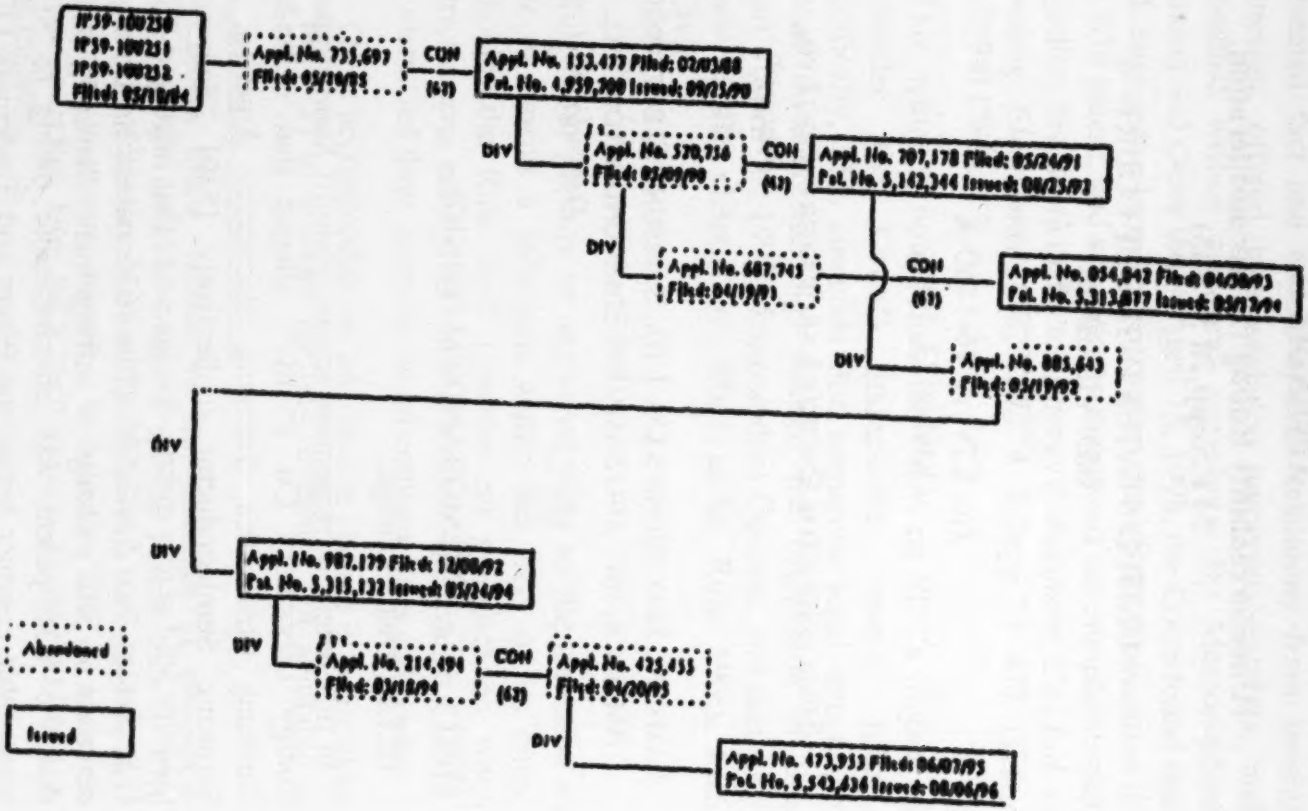
USP 5,543,636



APPENDIX G

(Unenforceability Ruling On Reconsideration, 24 F.Supp.2d 537-45)

UNITED STATES DISTRICT COURT
E.D. VIRGINIA

No. CIV. A. 96-1460-A
October 23, 1998

SEMICONDUCTOR ENERGY LABORATORY, CO., LTD.,
Plaintiff,

v.

SAMSUNG ELECTRONICS CO. LTD., SAMSUNG ELECTRONICS AMERICA, INC. AND SAMSUNG SEMICONDUCTOR, INC.,
Defendants.

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[538] MEMORANDUM OPINION

ELLIS, District Judge.

In this patent infringement action, plaintiff Semiconductor Energy Laboratory Co. ("SEL") alleged that defendants Samsung Electronics, Samsung Electronics America, and Samsung Semiconductor (collectively [539] "Samsung") made or sold active matrix display units that infringed SEL's U.S. Patent No. 5,543,636 ("the '636 patent"). Among its defenses to SEL's charge of infringement, Samsung alleged that the '636 patent was unenforceable owing to SEL's inequitable conduct before the Patent and Trademark Office ("PTO"). Between March 17, 1998 and April 3, 1998, a seven-day hearing was held on Samsung's affirmative defense of inequitable conduct, during which time the parties

presented fact and expert opinion testimony from several witnesses, offered into evidence numerous exhibits, and submitted written and oral arguments. By Memorandum Opinion and Order dated April 15, 1998, the Court found that SEL engaged in inequitable conduct during the prosecution of the '636 patent, and accordingly dismissed the complaint with prejudice. *See Semiconductor Energy Laboratory, Co., Ltd. v. Samsung Electronics Co., Ltd.*, 4 F.Supp.2d 477 (E.D.-Va.1998) ("SEL 1").

This matter is now before the Court on SEL's motion to reconsider the Court's inequitable conduct ruling. Specifically, SEL contends that numerous legal errors and factual misunderstandings formed the foundation of this Court's April 15, 1998 Memorandum Opinion, and that such errors entitle plaintiff to relief under Rule 59(e), Fed. R.Civ.P.[1]

I.

Rule 59(e) permits an aggrieved party to file a motion to alter or amend a judgment within ten days of its entry. Although the Rule itself provides no guidance on when district courts may grant such a motion, the Fourth Circuit[2] has identified three grounds for amending a prior judgment:

> (1) to accommodate an intervening change in controlling law; (2) to account for new evidence not available at

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[1] Although SEL's "Motion for Reconsideration of In-equitable Conduct Ruling" failed to invoke a specific Federal Rule of Civil Procedure, a motion for reconsideration, filed within ten days of the entry of judgment, is properly treated as a motion to alter or amend the judgment under Rule 59(e), Fed.R.Civ.P. *See in re Burnlev*, 983 F.2d 1, 2-3 (4th Cir.1992).

[2] The Federal Circuit generally defers to "regional circuit law when the precise issue involves an interpretation of the Federal Rules of Civil Procedure or the local rules of the district court." *Biodex Corp. v. Loredan Biomedical, Inc.*, 946 F.2d 850, 857 (Fed.Cir. 1991).

> trial; or (3) to correct a clear error of law or prevent manifest injustice.

E.E.O.C. v. Lockheed Martin Corp., 116 F.3d 110, 112 (4th Cir.1997)(citing Hutchinson v. *Staton*, 994 F.2d 1076, 1081 (4th Cir.1993)).

In the instant case, SEL does not assert the first ground as a basis for relief, but rather relies on the second and third. Yet, reliance on the second ground is misplaced, for "new evidence" must be "newly discovered since the judgment was entered." *Boryan v. United States*, 884 F.2d 767, 771 (4th Cir.1989). SEL's evidence does not satisfy this definition.[3] Thus, because "[e]vidence that is available to a party prior to entry of judgment . . . is not a basis for granting a motion for reconsideration as a matter of law,"[4] SEL must rely on the third ground as a basis for Rule 59(e) relief.

Therefore, to win Rule 59(e) relief, SEL must establish that there has been a clear error of law, or that a manifest injustice will result from enforcement of this Court's April 15, 1998 Order. *See Lockheed Martin*, 116 F.3d at 112.[5] SEL succeeds

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[3] SEL relies heavily in its motion for reconsideration on numerous documents not presented at trial, specifically, (i) several documents from patent prosecution files, (ii) two declarations, one from an individual never previously identified, and (iii) a supplemental report of one of Samsung's experts. Yet the record reveals, and SEL does not deny, that the evidence now offered in support of its Rule 59(e) motion was either in SEL's possession prior to trial or was attainable by SEL prior to trial.

[4] See *Borvan*, 884 F.2d at 771. A district court may, in its discretion, accept material that is not technically "new evidence," provided that a party's failure to produce it initially was justified. *See RCI, Inc. v. Unified Indus., Inc.*, 963 F.2d 658, 662 (4th Cir.1992). This is not such a case. SEL had ample notice of Samsung's inequitable conduct allegations, and offers "no justified reason" why these materials were not produced during the seven day hearing. *See id*

[5] SEL argues that its post-judgment declarations establish that the Court's ruling was based on an erroneous understanding of the evidence,

in neither [540] respect. First, SEL asserts two arguments with respect to its submission of a partially translated foreign application based on purportedly clear errors of law. But as this opinion reflects, (i) the Court correctly applied the right rule for "cumulative evidence" and (ii) PTO Rule 98(a)(3) does not excuse SEL's conduct. Second, SEL points out that the previous opinion proceeds on a mistaken assumption about which patent prosecution included certain misrepresentations and arguments made with respect to the Tsai reference. Nonetheless, this mistake of fact does not affect the result reached. Under settled principles of law, and sensible extensions of these principles, the same result obtains, even if, as it now appears, these arguments were made during the prosecution of the '455 application (No. 425,455) and the '494 application (No. 214,494) rather than the '636 patent.[6]

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and that consideration of these declarations is required to prevent a fundamental miscarriage of justice. Of course, the declarations in issue would be properly considered on those grounds. *See Lockheed Martin*, 116 F.3d at 112. Yet, rather than reveal any such error, the declarations submitted here merely reveal SEL's continued disagreement with this Court's findings. Indeed, the declarations advance essentially the same arguments that were advanced by SEL's experts at the hearing and ultimately found unpersuasive by the Court, *See SEL*, 4 F.Supp.2d at 482, n. 8.

[6] 6. SEL also asserts that

(i) the Court's treatment of the Sony '2073 patent was legal error,

(ii) the finding of *prima facie* obviousness from the combination of the Japanese laid-open Application No. 56-135968, assigned to Canon K,K, (the "Canon '968 application") and a 1983 article by Dr. C.C. Tsai, titled "Amorphous Si Prepared in a UHV Plasma Deposition System" (the "Tsai reference" or "Tsai article") was legal error,

(iii) estoppel precludes Samsung from arguing that the Canon '968 Application is not cumulative evidence,

(iv) the Court's finding regarding the '636 IDS's summary of the Canon '968 application is an error of fact and law,

II.

A. The Canon '968 Application

In *SEL I*, the Court found that SEL engaged in inequitable conduct before the PTO in connection with its submission to the PTO of the Canon '968 application when it chose to submit a partial translation and a summary that together concealed the materiality of the Canon '968 application. *See SEL*, 4 F.Supp.2d at 494-95. SEL, of course, disagrees. It argues first that the Court's finding that the Canon '968 application was material, and hence not cumulative of other information before the PTO, was based on an improper legal standard. Second, SEL argues that its submission of a partial translation of the Canon '968 application that was already in existence cannot constitute inequitable conduct as a matter of law. Both arguments are meritless and warrant no Rule 59(e) relief.

1. The Canon '968 Application Was Not Cumulative

It is undisputed that information that is cumulative to information already of record is not material to patentability. 37 C.F.R. § 1.56. Also essentially undisputed is that, as noted in *SEL I*, "a withheld reference may be highly material when it discloses a more complete combination of relevant features, even if those features are before the patent examiner in other references." *SEL*, 4 F.Supp.2d at 482 (citing *Molins*,[7]

(v) the Court's understanding of the '636 patent's claim is legal error, and

(vi) SEL's arguments about the Tsai reference were not frivolous or inconsistent.

Yet, these arguments are mere reassertions of arguments advanced and rejected in *SEL I*, and thus are inappropriate on a Rule 59(e) motion and need not be addressed again here.

[7] *See Molins PLC v. Textron, Inc.*, 48 F.3d 1172, 1180 (Fed.Cir. 1995) (reference material where it showed a combination of the elements for

LaBounty,[8] *In re Jerabek*[9]). SEL contends that the Court oversimplified [541] the standard in its materiality analysis by simply counting the number of elements disclosed in the Canon '968 application without any consideration for whether the disclosure of that combination was actually significant. Yet, SEL is mistaken. The fact that no other reference before the examiner contained as complete a combination of the '636 patent's elements as in the untranslated portions of the Canon '968 application was, of course, central to the Court's conclusion that the Canon '968 application was not merely cumulative. *See Id.* at 484. But the conclusion was additionally informed by the fact that the absence of a fully translated Canon '968 application before the PTO enabled SEL to make arguments in support of patentability that it otherwise would not have been able to make. *See id.* at 494, Thus, contrary to SEL's assertion, the Court did not simply apply a "mathematical formula" to determine materiality.[10]

2. PTO Rule 98(c) Does Not Excuse SEL's Inequitable Conduct

In connection with its '636 patent application, SEL submitted (i) a full 29-page Japanese language version of the Canon '968 application, (ii) a one-page partial translation of

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which the examiner had relied upon two separate references to reject the patent application claims).

[8] *LaBounty Mfg., Inc. v. United States Int'l Trade Comm'n*, 958 F.2d 1066, 1075-76 (Fed. Cir. 1992)(undisclosed items were material when they disclosed "more relevant features" than the cited items).

[9] *In re Jerabek*, 789 F,2d 886, 890 (Fed,Cir,1986)(withheld reference material when no single piece of cited prior art taught the combination present in the reference).

[10] While SEL may disagree with the Courts application of the cumulative evidence standard, "mere disagreement does not support a Rule 59(e) motion." *See Hutchinson*, 994 F.2d at 1081.

the Canon '968 application disclosing the use of a silicon nitride gate insulator in a thin film transistor ("TFT"), and (iii) a statement describing the Canon '968 application's relevance to the '636 patent as " 'disclos[ing] the use of silicon nitride for a gate insulating layer of a [TFT].' " *See SEL*, 4 F.Supp.2d at 483. Yet, as *SEL I* noted, the Canon '968 application's relevance to the patentability of the invention claimed in the '636 patent was far more substantial. *See Id.* Indeed, the evidence adduced at trial was clear and convincing that the Canon '968 application disclosed other elements of the invention claimed in the '636 patent, elements which formed a basis for SEL's patentability argument.[11] *See id*, 4 F.Supp.2d at 494. In finding inequitable conduct, the Court concluded that SEL knew that the untranslated portions of the Canon '968 application disclosed these additional elements, and that SEL deliberately attempted to conceal the true significance of the Canon '968 application to ensure the issuance of the '636 patent. *See id.*

In its motion to reconsider, SEL argues unpersuasively that because the partial translation of Canon was prepared in

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[11] Specifically, the untranslated portion of the Canon '968 application described the same TFT structure that is found in the '636 patent: a structure with the same intrinsic semiconductor layer made from amorphous silicon; the same channel region sandwiched between the insulators; and (in both the translated and the untranslated portions), the same silicon nitride gate insulator as claimed in the '636 patent. *See SEL*, 4 F.Supp.2d at 483. The untranslated portions of the Canon '968 application also provided the "frequent admonitions to prevent or limit atmospheric impurities in semiconductor materials, which provide an express suggestion to employ teachings such as those found in the Tsai article or in the '423 or the '488 applications to reduce carbon, oxygen and nitrogen impurities below the levels claimed in the '636 patent." *See id.* Thus, the Court found by clear and convincing evidence that the 'untranslated portions of the Canon '068 application contained information highly material to the prosecution of the '636 patent application as they, together with other information, establish a *prima facie* case of unpatentability." *See id.* at 484.

connection with a prior patent application, and because its submission was thus required by Rule 98(c), 37 C.F.R. § 1.98(c), SEL's conduct in this regard cannot constitute inequitable conduct. In relying on Rule 98(c) to excuse the failure to submit a fully translated version to the PTO. SEL places more weight on the rule than it can bear. Rule 98(c) requires an applicant to submtt any translations of a reference that they might possess. But that rule provides a floor for required submissions of translations of foreign applications, not a ceiling; it is by no means an excuse or license for concealing material portions of a prior art reference. Yet, SEL's submission of the partial translation combined with its brief statement of relevance does just that.[12] Thus, reliance on [542] Rule 98 (a)(3) affords SEL no relief from the effects of its conduct.

In short, SEL's inequitable conduct with respect to the Canon '968 is an adequate and independent basis for finding the '636 patent unenforceable as a result of inequitable conduct; [13] SEL's arguments to the contrary are meritless.

B. The Tsai Reference

SEL I proceeded on the premise that misrepresentations concerning the Tsai reference were made with respect to the '636 patent application, whereas in fact, they were made with

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[12] *See SEL*, 4 F.Supp.2d at 494 ("SEL's brief statement of relevance identifying only the silicon nitride gate as pertinent, coupled with the partial translation disclosing that element, certainly removed any incentive [for the examiner to secure a full translation].").

[13] In *SEL I*, the Court found that credible expert testimony convincingly established that the fully translated Canon '968 application, when combined with the Tsai reference, rendered obvious the asserted claims of the '636 patent. *See SEL*, 4 F.Supp.2d at 484. Because the Tsai article did not individually create a *prima facie* case of obviousness, the failure to submit a fully translated version of the Canon '968 application is in and of itself sufficient to justify a finding of inequitable conduct.

respect to the related '455 and '494 applications.[14] Given this, SEL argues, the misrepresentations concerning the Tsai reference cannot support a finding of inequitable conduct with respect to the '636 patent, and SEL is therefore entitled to relief.[15]

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[14] *SEL I* set forth in some detail the facts regarding the relationship of some of the relevant patents and patent applications and attached a diagram which clarifies these relationships. *See SEL*, 4 F.Supp.2d at 480 and Appendix. In summary, the '636 patent results from continuation and divisional applications from the application that issued as the '132 patent. Specifically, the '494 application was a divisional application of the patent application that became the '132 patent; the '455 application was filed as a continuation application of the '494 application pursuant to PTO Rule 62, thus causing the automatic abandonment of the '494 application. The '953 application, which eventually became the '636 patent, was filed as a divisional application of the '455 application, pursuant to PTO Rule 60. Thus the priority date of the '636 patent relies on the chain of applications that includes the '132 patent, the '494 application and the '455 application. Further, the subject matter of the '636 patent is so closely related to the '132 patent that a terminal disclaimer was filed with respect to the '636 patent, giving it the expiration date of the '132 patent. Both the '132 and the '636 patents rely upon the May 18, 1984 filing date for SEL's Japanese laid-open Application No, 59100250 ("the '250 application"), which has a "one-to-one" relationship with both the '132 and '636 patents. Both the '132 and the '636 patents have the same inventor (Dr. Yamazaki), owner (SEL), disclosure, specification, and title.

[15] SEL also contends that it is clear legal error to base a finding of inequitable conduct on arguments presented to the PTO in support of a patent application. SEL bases this contention on a misinterpretation of two distinguishable cases, neither of which stands for the proposition that, as a matter of law, arguments made to the PTO cannot constitute inequitable conduct. *See Akzo NV. v. United States Int'l Trade Comm'n*, 808 F.2d 1471 (Fed.Cir.1986); *Hughes Aircraft Co. v. United States*, 215 U.S.P.Q. 787, 1982 WL 36740 (Ct.Cl.Trial Div.1982), *aff'd in part, rev'd in part*, 717 F.2d 1351 (Fed.Cir.1983). In *Akzo*, the Federal Circuit held that where neither a "proved material misrepresentation [n]or a proved intent to mislead" exists, the moving party does not meet its burden of proving inequitable conduct. 808 F.2d at 1482. Thus, by implication where, as here, material misrepresentations are made in a position advocated to the PTO with intent to mislead, inequitable conduct does exist. Likewise,

As *SEL I* makes clear, SEL's arguments regarding the Tsai article constituted inequitable conduct because they were (i) knowingly contrary to SEL's own knowledge, (ii) invalid under scientific principles certainly known to Dr. Yamazaki, and (iii) inconsistent with SEL's other positions before the PTO. *SEL*, 4 F.Supp.2d at 484-86.[16] Equally clear is that these arguments constitute inequitable conduct in the context of the prosecution of the related '494 and '455 patent applications, for these applications, like the related [543] '636 patent application, were prosecuted (i) long after the relevant knowledge was available and (ii) while SEL was advocating inconsistent positions to the PTO with respect to the U.S. No. 5,521,400 (" '400") patent.[17]

Hughes Aircraft provides no support for SEL's contention. There, unlike the case at bar, the Court of Claims expressly found that the statements quoted by the defendant were neither untrue nor inconsistent with the defendant's prior positions. 215 U.S.P.Q. at 805, 1982 WL 36740.

[16] Specifically, SEL's argument that the teachings of the Tsai article were primarily applicable to solar cells, not TFTs, was "contrary to its own knowledge, and inconsistent with its own previously stated position on an important issue before the PTO." *SEL*, 4 F.Supp.2d at 484-85. Further, SEL's attempt to distinguish the article on the basis of the direction of the current had no validity, and Dr. Yamazaki, SEL's president and majority shareholder, the inventor of the '636 patent, and a distinguished solid state physicist, surely knew that. *Id.*

[17] The '494 application was filed in 1994; the '455 application was filed in 1995. The Tsai article, which would have been understood by persons of ordinary skill in the pertinent art to apply to TFT's as well as solar cells, was available from 1983. *See SEL*, 4 F.Supp.2d at 489. By 1984, through the '423 and '488 Japanese laid-open applications. Dr. Yamazaki and demonstrated that he recognized "a clear connection between solar cells and TFT's in that the importance of reducing impurities is applicable to both. *Id.* at 485. Moreover, the application of the '400 patent was filed in November 1994, and issued in May 1996, and thus any arguments SEL presented to the PTO during the prosecution of that patent must have been essentially contemporaneous with the arguments advanced in the prosecution of the '455 and '494 applications.

The question now presented, therefore, is whether inequitable conduct in the course of prosecuting the '494 and '455 applications can serve to invalidate the '636 patent, given that these applications are in the direct chain of divisional and continuation applications leading ultimately to the issuance of the '636 patent. More generally, the question is whether a patent can be rendered unenforceable as a result of inequitable conduct that occurred in the prosecution of related divisional and continuation applications earlier in the chain of applications that spawned the patent in issue. Analogous Federal Circuit authority points persuasively to the conclusion that under appropriate circumstances, inequitable conduct earlier in the direct patent chain can render the related ultimately-issued patent unenforceable.[18]

Analysis of the issue appropriately begins with *Fox Industries, Inc. v. Structural Preservation Systems, Inc.*, 922 F.2d 801 (Fed.Cir.1990), where the Federal Circuit broadly enunciated the guiding principle that "[t]he duty of candor extends through the patent's entire prosecution history," and that a breach of the duty of candor "may render unenforceable all claims which eventually issue from the same *or a related application*." 922 F.2d at 803-04 (emphasis added).[19] This

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[18] In any event, because SEL's inequitable conduct with respect to the Canon '968 application constituted an independent and adequate ground for the result reached in *SEL I*, no manifest injustice would result from enforcement of the April 15, 1998 Order holding the '636 patent unenforceable. Thus SEL's contention here concerning the Tsai reference, even if valid, would not satisfy the threshold requirement under Rule 59(e), Fed.R.Civ.P.

[19] *Fox* involved a chain of related applications, the last of which led to the issuance of the challenged patent. There, the original patent attorney knowingly withheld material prior art during the prosecution of earlier applications, but did not draft the pertinent claims as ultimately issued. *See Fox*, 922 F.2d at 803-04. The district court nonetheless found, and the Federal Circuit affirmed, that the attorney's failure to disclose that material prior art constituted inequitable conduct as to the ultimately-issued patent. *See Id.* 922 F.2d at 804. The court also affirmed the district

principle is not without limits. Pertinent Federal Circuit authority also teaches that the mere occurrence of inequitable conduct in connection with an application within a chain of applications is not enough to invalidate a patent issued as a result of a later application in the chain: instead, the earlier inequitable [544] conduct in the chain must be related to the targeted claims of the ultimately-issued patent or patents sought to be enforced.[20] Thus, a patent that issues from a divisional or continuation application may be held unenforceable where (i) there is inequitable conduct with respect to the prosecution of an earlier related application in the chain leading to the challenged patent and (ii) the inequitable conduct relates to the asserted claims of that patent.[21] Were this not the rule, a party committing inequitable conduct could avoid the consequences of that conduct through a scheme of divisional and continuation applications. The law

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court's conclusion that the patent's inventor had intentionally withheld the material prior art throughout the chain of applications, including the application that led to the issuance of the challenged patent. *Id.*

[20] *See Baxter Int'l, Inc. v. McGaw*, 149 F.3d 1321, 1332 (Fed.Cir.1998) (patent issued from divisional application not unenforceable "where the issued claims have no relation to the omitted prior art"); *Consolidated Aluminum Corp. v. Foseco Int'l Ltd.*, 910 F.2d 804, 809-11 (Fed.Cir. 1990) (patents-in-suit unenforceable where inequitable conduct in original application allowed successful arguments in prosecution of patents-in-suit not otherwise possible); *see also East Chicago Machine Tool Corp. v. Stone Container Corp.*, 181 U.S.P.Q. 744, 748 (N.D.Ill.1974), *tacated in part on other grounds*, 185 U.S.P.Q. 210 (N.D.Ill.1974); *Molins PLC v. Textron, Inc.*, 821 F.Supp. 1551, 1581 (D.Del.1992), *affd in part, vacated in part on other grounds*, 48 F.3d 1172, 1187 (Fed.Cir.1995); *Jack Frost Laboratories, Inc. v. Physicians & Nurses Mfg. Corp.*, 901 F.Supp. 718, 729 (S.D.N.Y. 1995), *aff'd*, 124 F.3d 229, 1997 WL 592314 (Fed.Cir.1997).

[21] This principle is also consistent with PTO Rule 56, 37 C.F.R. § 1.56, which makes clear that no patent will be granted on any application "in connection with which" fraud or intentional misconduct occurred or was attempted.

does not countenance such a manipulation of the patent process.

Application of this principle to the instant facts[22] compels the conclusion that SEL's inequitable conduct in connection with the '494 and '455 applications and the earlier '132 patent[23] renders the '636 patent unenforceable. Not only are the omitted prior art and misrepresentations directly relevant to the asserted claims of the '636 patent, but SEL's motivation in prosecuting that patent, *i.e.*, to conceal its prior inequitable conduct rather than cure it, links the issued patent itself directly to the inequitable conduct. In the circumstances, therefore, SEL's inequitable conduct in connection with the '494 and '455 applications and the '132 patent fatally infects the '636 patent.

Seeking to avoid this result, SEL argues that it is enough that it complied with the PTO's disclosure requirements during the prosecution of the specific continuation application

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[22] Those facts are as follows: SEL, in prosecuting the '494 and '455 applications, intentionally distinguished the Tsai article and knowingly minimized its significance on the basis of invalid arguments. *See supra* n. 17 and accompanying text. Moreover, in its prosecution of the '132 patent, SEL knowingly (i) misrepresented the atomic density of amorphous silicon in order to persuade the examiner to allow the claims over the Nakagawa '477 application, and (ii) failed to disclose highly material prior art, specifically the Tsai reference and the '423 and '488 Japanese laid-open applications. *SEL*, 4 F.Supp.2d at 486-91. *SEL I* also makes clear that Dr. Yamazaki realized that SEL's conduct left the '132 patent vulnerable, and sought a new patent, the '636 patent, hoping to insulate the '636 patent from the defects infecting the '132 patent that resulted from such conduct. *SEL*, 4 F.Supp.2d at 495.

[23] The inequitable conduct associated with the prosecution of the '132 patent was previously treated only as Rule 404(b) evidence. *See SEL*, 4 F.Supp.2d at 487, n. 16 and accompanying text. Under the principles elucidated here, inequitable conduct in the course of the prosecution of the '132 patent constitutes an additional basis on which the '636 patent is unenforceable.

leading to the '636 patent. This argument fails factually and legally. It ignores SEL's inequitable conduct concerning the Japanese Canon '968 application, and beyond this, is based on an incorrect understanding of the applicable disclosure requirements. It is not enough that by the time the '636 patent issued, SEL had disclosed the Tsai reference, the correct figure for silicon atomic density and the '423 and '488 Japanese laid-open applications, and had also apparently ceased actively advocating the invalid arguments with respect to the Tsai article. Settled authority makes clear that the duty of candor requires more to cure inequitable conduct. Specifically, *Rohm & Haas Co. v. Crystal Chem. Co.*, 722 F.2d 1556 (Fed.Cir. 1983) teaches that the applicant must (i) expressly advise the PTO of the misrepresentation's existence, (ii) advise the PTO of what the actual facts are and make clear that further examination in light thereof may be required if any PTO action has been based on the misrepresentation, and (iii) establish patentability on the basis of the factually accurate record. *Rohm & Haas*, 722 F.2d at 1572. In support of these cure requirements, the Federal Circuit stated,

> It does not suffice that one knowing of misrepresentations in an application or in its prosecution merely supplies the examiner with accurate facts without calling his attention to the untrue or misleading assertions sought to be overcome, leaving him to formulate his own conclusions.

Id. 722 F.2d at 1572.[24] Inequitable conduct earlier in a chain of related patent applications must be cured in accordance with *Rohm & Haas* or it will continue to infect the [545] process; cure cannot be achieved through manipulation of

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[24] In *Rohm & Haas*, the record was devoid of any evidence showing that the PTO had been told that any misrepresentations had been made and precisely where they had been made. Given this, the court held that the "cure" was insufficient as a matter of law. *Id.* 722 F.2d at 1572-73.

patent prosecution procedures, such as canceling or amending claims or filing continuation and divisional applications.[25] Nothing in the record suggests that SEL took any steps to cure the directly related inequitable conduct; because it pursued a separate, related application instead of seeking reissuance under 35 U.S.C. § 251, for which it was probably not eligible,[26] SEL did not surrender and amend the '132 patent, identify its previous omissions, comply with the requisite cure requirements and establish patentability on a clearly corrected record.

In these circumstances, the inequitable conduct that occurred earlier in the patent chain renders a later patent unenforceable. Thus, the inequitable conduct in the '636 patent chain, i.e. in the prosecution of the '132 patent and the '494 and '455 patent applications, provides an additional alternate and independent ground on which the '636 patent is unenforceable.

III.

SEL has not established any clear error of law in connection with the April 15, 1998 Order rendering the '636 patent unenforceable. Nor has it shown that a manifest injustice will result from enforcement of that order. Indeed, the analysis here confirms that the inequitable conduct that occurred with respect to the '494 and '455 applications and the '132 patent is a separate and independent ground rendering the '636 patent unenforceable that supplements the separate and independent ground found in the April 15, 1998

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[25] *See, e.g., Baxter,* 149 F.3d at 1331 *(Fox* reflects principle that "omission of a reference material to certain claims cannot be cured simply by canceling or amending these claims dunng prosecution so that they do not issue in the same form in which they were drafted"); *Driscoll v. cebalo,* 731 F.2d 878, 884 (Fed.Cir.1984) (nondisclosure of material prior art during prosecution of parent application not excused by substituting related claims in later application without calling to PTO's attention earlier failure to disclose).

Memorandum Opinion, namely, SEL's inequitable conduct with respect to the Canon '968 application.

An appropriate Order will issue.

ORDER

The matter came before the Court on plaintiff SEL's motion to reconsider its April 15, 1998 Order.

For the reasons stated in the accompanying Memorandum Opinion, plaintiff's motion is DENIED.

The Clerk is directed to place this matter among the ended causes.

APPENDIX H

(Federal Circuit Order Denying Rehearing En Banc)

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

[Filed Apr. 26, 2000]

98-1377, 99-1103

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.,
Plaintiff-Appellant,

v.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
and SAMSUNG SEMICONDUCTOR, INC.,
Defendants-Cross Appellants.

ORDER

A combined petition for rehearing* and petition for rehearing en banc having been filed by the APPELLANT, and a response thereto having been invited by the court and filed by the CROSS-APPELLANTS, and the petition for rehearing having been referred to the panel that heard the appeal, and thereafter the petition for rehearing en banc and response having been referred to the circuit judges who are in regular active service,

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* The petition for rehearing was granted by separate order on March 29, 2000 to amend the opinion issued on March 2, 2000.

UPON CONSIDERATION THEREOF, it is

ORDERED that the petition for rehearing en banc be, and the same hereby is, DENIED.

The mandate of the court will issue on May 3, 2000.

Circuit Judge Linn did not participate in the vote.

FOR THE COURT,

/s/ Jan Horbaly
JAN HORBALY
Clerk

Dated: April 26, 2000

cc: J. Alan Galbraith
David J. Healey

APPENDIX I

(35 U.S.C. § 6(a) (1991))

§ 6 Duties of Commissioner

(a) The Commissioner, under the direction of the Secretary of Commerce, shall superintend or perform all duties required by law respecting the granting and issuing of patents and the registration of trademarks; shall have the authority to carry on studies, programs, or exchanges of items or services regarding domestic and international patent and trademark law or the administration of the Patent and Trademark Office, including programs to recognize, identify, assess and forecast the technology of patented inventions and their utility to industry; and shall have charge of property belonging to the Patent and Trademark Office. He may, subject to the approval of the Secretary of Commerce, establish regulations, not inconsistent with law, for the conduct of proceedings in the Patent and Trademark Office.

Note: The PTO's power to establish regulations is now found in 35 U.S.C. § 2(b)(2)(1999).

APPENDIX J

(35 U.S.C. § 8 (1975))

§ 8. Library

The Commissioner shall maintain a library of scientific and other works and periodicals, both foreign and domestic, in the Patent and Trademark Office to aid the officers in the discharge of their duties.

APPENDIX K

(PTO Rule 56)
(37 C.F.R. § 1.56)

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

APPENDIX L

(PTO Rule 98)
(37 C.F.R. § 1.98)

Content of information disclosure statement.

(a) Any information disclosure statement filed under § 1.97 shall include:

(1) A list of all patents, publications, or other information submitted for consideration by the Office;

(2) A legible copy of:

(i) Each U.S. and foreign patent;

(ii) Each publication or that portion which caused it to be listed; and

(iii) All other information or that portion which caused it to be listed, except that no copy of a U.S. patent application need be included; and

(3) A concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein.

(b) Each U.S. patent listed in an information disclosure statement shall be identified by patentee, patent number and issue date. Each foreign patent or published foreign patent application shall be identified by the country or patent office which issued the patent or published the application, an appropriate document number, and the publication date indicated on the patent or published application. Each publication shall be identified by author (if any), title, relevant pages of the publication, date and place of publication.

(c) When the disclosures of two or more patents or publications listed in an information disclosure statement are substantively cumulative, a copy of one of the patents or publications may be submitted without copies of the other patents or publications provided that a statement is made that these other patents or publications are cumulative. If a written English-language translation of a non-English language document, or portion thereof, is within the possession, custody or control of, or is readily available to any individual designated in § 1.56(c), a copy of the translation shall accompany the statement.

(d) A copy of any patent, publication or other information listed in an information disclosure statement is not required to be provided if it was previously cited by or submitted to the Office in a prior application, provided that the prior application is properly identified in the statement and relied upon for an earlier filing date under 35 U.S.C.120.

APPENDIX M

(Notice of Final Rulemaking)
57 Fed. Reg. 2021
(January 17, 1992)
(Pertinent Text)

DEPARTMENT OF COMMERCE

Patent and Trademark Office

37 CFR Parts 1 and 10

Docket No. 910764-1306

RIN 0851-AA27

Duty of Disclosure

AGENCY: Patent and Trademark Office, Commerce

ACTION: Notice of final rulemaking.

Summary: The Patent and Trademark Office (Office) is amending the rules of practice in patent cases to (1) clarify the duty of disclosure for information required to be submitted to the Office; (2) provide flexible time limits for submitting information disclosure statements including the requirement for a fee in certain cases; (3) eliminate consideration of duty of disclosure issues by the Office except in disciplinary and interference proceedings, and under other limited circumstances and (4) eliminate the striking of patent applications which are improperly executed. The Office further is amending the Patent and Trademark Office Code Of Professional Responsibility to define as misconduct a failure to comply with the rules on duty of disclosure. The rules as adopted strike a balance between the need of the Office to obtain and consider all known relevant information pertaining to patentability before a patent is granted and the desire to avoid or minimize unnecessary complications in the enforcement of patents.

EFFECTIVE DATE: March 16, 1992. These rules will be applicable to all applicants and reexamination proceedings pending or filed after the effective date.

* * *

Changes in Text

[57 Fed. Reg. 2022]

The final rule contain several changes to the text of the rules as proposed for comment. Those changes are discussed below.

Section 1.17(t)(1) has been changed from the proposed text to reflect the recent increase in the amount of the fee for filing a petition from $120.00 to $130.00.

Section 1.56(a) has been clarified to indicate that the duty of an individual to disclose information is based on the knowledge of that individual that the information is material to patentability. A sentence has been added to § 1.58(a) to express the principle that the Office does not condone the granting of a patent on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or international misconduct. In addition, § 1.58(a) as proposed has been changed to indicate that if all information material to patentability of any claim issued in a patent is cited by the Office or submitted to the Office in the manner prescibed by §§ 1.97(b)-(d) and 1.95, the Office will consider as satisfied the duty to disclose to the Office all information known to be material to patentability, as contrasted to the broader duty of candor and good faith. This rule does not attempt to define the spectrum of conduct that would lack the candor and good faith in dealing with the Office which is expected of individuals who are associated with the filing or prosecution of a patent application.

* * *

Response to and Analysis of Comments

57 Fed. Reg. 2023

Sixty (60) written comments were received in response to the notice of proposed rulemaking. These comments, along with those made at the public hearing, have been analyzed. Some suggestions made in the comments have been adopted and others have been rejected. Response to the comments follow.

* * *

[57 Fed. Reg. 2023]

Comment 1. Nine comments indicated that the Office should not amend § 1.56 since it is presently in conformance to the materiality standard being applied by the Court of Appeals for the Federal Circuit. One comment questioned what practical value of the proposed rule would justify the burden of the change.

Reply: The amendment to § 1.56 was proposed to address criticism concerning a perceived lack of certainty in the materiality standard. The rule as promulgated will provide greater clarity and hopefully minimize the burden of litigation on the question of inequitable conduct before the Office, while providing the Office with the information necessary for effective and efficient examination of patent applications.

* * *

[27 Fed. Reg. 2023-24]

Comment 4. One comment stated that promulgation of the proposed rule would result in a significant decrease in the quantity of art cited to the Office because there will be no duty to cite art relevant to a pending claim.

Reply: The Office does not anticipate any significant change in the quantity of information cited to the Office after promulgation of amended § 1.56. Presumably, applicants will

continue to submit information for consideration by the Office in applications rather than making and relying on their own determinations of materiality. An incentive remains to submit the information to the Office because it will result in a strengthened patent and will avoid later questions of materiality and intent to deceive. In addition, the new rules will actually facilitate the filing of information since the burden of submitting information to the Office has been reduced by eliminating, in most cases, the requirement for a concise statement of the relevance of each item of information listed in an information disclosure statement.

* * *

[57 Fed. Reg. 2026]

Comment 24. One comment stated that the language "or in combination with other information" should be removed from proposed § 1.56(b)(1) because it was unworkable to require an applicant to combine references against its own claims, especially since, according to the commentator, examiners and the Board of Patent Appeals and Interferences frequently misapply the law. Another comment stated that the language creates an open field for litigators to claim that an inordinate number of references could be combined.

Reply: The rule does not require an applicant to combine references against its own claims. The applicant can submit information to the Office for the examiner's consideration whether the information is considered material or not. The fact that the teachings of a large number of references must be combined for a prima facie case of obviousness does not by Itself weigh against a holding of obviousness. See *In re Gorman*, 933 F2d 982, 18 USPQ2d 1885 (Fed. Cir. 1991).

* * *

[57 Fed. Reg. 2026]

Comment 26. One comment stated the proposed § 156(b)(1) placed a burden on the practitioner to analyze references that is inappropriate and contradictory to a practitioner's responsibility to his client.

Reply: The rule itself does not place a burden on the practitioner to analyze references. Information can be submitted to the Office in accordance with §§ 1.97 and 1.98, and the examiner will consider the references.

* * *

[57 Fed. Reg. 2031]

Comment 70. One comment suggested that propoeed § 1.98(a)(3) should be to require a concise explanation of "what is believed to be" the relevance of information listed to avoid the accusation of violation of duty of disclosure merely because more relevant portions of the information are later found, Another comment suggested that the concise explanation should state what is "reasonably understood by the person submitting the statement." Another comment stated that the applicant should be required to explain (1) only what is understood or believed about the item of information at the time the disclosure is made, or (2) why the Item is listed.

Reply: The suggestions in the comments have been substantially adopted in modifying the language of § 1.98(a)(3).

APPENDIX N

(1138 OFFICIAL GAZETTE 37 (May 19, 1992)) (Pertinent Text)

[37] Processing of Information Disclosure Statements Under the New Rules Effective March 16, 1992

The Office has set forth the minimum requirements for information to be considered in 37 CFR 1.97 and 1.98. Once the minimum requirements are met, the examiner has an obligation to consider the information. These rules provide certainty for the public by defining what the requirements are, when the Office will consider information, and when the Office will not consider information.

APPENDIX O

MPEP § 609
(Pertinent Text)

609 Information Disclosure Statement

* * *

An information disclosure statement filed in accordance with the provisions of the 37 CFR 1.97 and 1.98 provides the procedure available to an applicant to submit information to the Office so that the information will be considered by the examiner assigned to the application. The requirements for the content of a statement have been simplified in the new rules which became effective on March 16, 1992, to encourage individuals associated in a substantive way with the filing and prosecution of a patent application to submit information to the Office so the examiner can determine its relevance to the claimed invention. The procedures for submitting an information disclosure statement under the new rules are designed to encourage individuals to submit information to the Office promptly.

In order to have information considered by the Office during the pendency of a patent application, an information disclosure statement in compliance with 37 CFR 1.98 as to content must be filed in accordance with the procedural requirements of 37 CFR 1.97. The requirements as to content are discussed in A below. The requirements based on the time of filing the statement are discussed in B below. Examiner handling of information disclosure statements is discussed in C below.

The Office has set forth the minimum requirements for information to be considered in 37 CFR 1.97 and 1.98. Once the minimum requirements are met, the examiner has an obligation to consider the information. These rules provide certainty for the public by defining the requirements for submitting information to the Office so that the Office will

consider information before a patent is granted. Information submitted to the Office that does not comply with the requirements of 37 CFR 1.97 and 1.98 will not be considered by the Office but will be placed in the application file.

The filing of an information disclosure statement shall not be construed as a representation that a search has been made. 37 CFR 1.97(g). There is no requirement that an applicant for a patent make a patentability search. Further, the filing of an information disclosure statement shall not be construed to be an admission that the information cited in the statement is, or is considered to be, material to patentability as denied in 37 CFR 1.56(b). 37 CFR 1.97(h). See MPEP § 2129 regarding admissions by applicant.

* * *

The examiner will consider the documents cited in the international search report in a PCT national stage application, when the Form PCT/DO/EO/903 indicates that both the international search report and the copies of the documents are present in the national stage file. In such a case, the examiner should consider the documents from the international search report and indicate by a statement in the first Office action that the information has been considered. There is no requirement that the examiner list the documents on a PTO-892 form.

A. CONTENT

An information disclosure statement must comply with the provisions of 37 CFR 1.98 as to content in order to be considered by the Office. Each information disclosure statement must comply with the applicable provisions of A(1), A(2), and A(3) below.

A(1) Each information disclosure statement must include a list of all patents, publications, or other information submitted for consideration by the Office.

37 CFR 1.98(b) requires that each U.S. patent listed in an information disclosure statement be identified by patentee, patent number, and issue date. Each foreign patent or published foreign patent application must be identified by the country or patent office which issued the patent or published the application, an appropriate document number, and the publication date indicated on the patent or published application. Each publication must be identified by author (if any), title, relevant pages of the publication, date and place of publication. The date of publication supplied must include at least the month and year of publication, except that the year of publication (without the month) will be accepted if the applicant points out in the information disclosure statement that the year of publication is sufficiently earlier than the effective U.S. filing date and any foreign priority date so that the particular month of publication is not in issue. The place of publication refers to the name of the journal, magazine, or other publication in which the information being submitted was published.

To comply with this requirement, the list may not be incorporated into the specification, but must be submitted in a separate paper. A separate list is required so that it is easy to confirm that applicants intends to submit an information disclosure statement and because it provides a readily available checklist for the examiner to indicate which identified documents have been considered. A copy of a separate list will also provide a simple means of communication to applicant to indicate the listed documents that have been considered and those listed documents that have not been considered. Use of form PTQ-1449, information Disclosure Citation, is encouraged. See C(2) below.

A(2) In addition to the list, each information disclosure statement must also include a legible copy of:

(i) Each U.S. and foreign patent;

(ii) Each publication or that portion which caused it to be listed; and

(iii) All other information or that portion which caused it to be listed, except that no copy of a U.S. patent application need be included.

There are exceptions to this general rule that a copy must be provided. First, 37 CFR 1.98(d) states that a copy of any patent, publication, or other information listed in an information disclosure statement is not required to be provided if it was previously cited by or submined to the Office in a prior application, provided that the prior application is properly identified in the statement and relied on for an earlier filing date under 35 U.S.C 120. The examiner will consider information cited or submitted to the Office in a prior application relied on under 35 U.S.C 120. This exception to the requirement for copies of information does not apply to information which was cited in an international application under the Patent Cooperation Treaty. If the information cited or submitted in the prior application was not in English, a concise explanation of the relevance of the information to the new application is not required unless the relevance of the information differs from its relevance as explained in the prior application. See A(3) below.

Second, 37 CFR 1.98(c) states that when the disclosures of two or more patents or publications listed in an information disclosure statement are substantively cumulative, a copy of one of the patents or publications may be submitted without copies of the other patents or publications provided that a statement is made that these other patents or publications are cumulative. The examiner will then consider only the patent or publication of which a copy is submitted and will so indicate on the list or form PTO-1449 submitted; e.g., by crossing out the listing of the cumulative information.

37 CFR 1.98(c) further states that if a written English language translation of a non-English language document, or thereof, is within the possession, custody or control of, or is readily available to any individual designated in 37 CFR 1.56(c), a copy of the translation shall accompany the statement. Translations are not required to be filed unless they have been reduced to writing and are actually translations of what is contained in the non-English language information. If no translation is submitted, the examiner will consider the information in view of the concise explanation and insofar as it is understood on its face; e.g., drawings, chemical formulas, English language abstracts, in the same manner that non-English language information in Office search files is considered by examiners in conducting searches.

A(3) Each information disclosure statement must further include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein.

The requirement for a concise explanation of relevance is limited to information that is not in the English language. The explanation required is limited to the relevance as understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information at the time the information is submitted to the Office. If a translation of the information into English is submitted with the foreign language information, no concise explanation is required. An English-language equivalent application may be submitted to fulfill this requirement if it is, in fact, a translation of a foreign language application being listed in an information disclosure statement. There is no requirement for the translation to be verified. Submission of an English

language abstract of a reference which does not deal with its relevance to the invention will not fulfill the requirement for a concise explanation. Where the information listed is not in the English language, but was cited in a search report or other action by a foreign patent office in counterpart foreign application, the requirement for concise explanation of relevance can be satisfied by submitting an English-language version of the search report or action which indicates the degree of relevance found by the foreign office. This may be an explanation of which portion of the reference is particularly relevant to which claims it applies, or merely an "X," "Y," or "A" indication on a search report. The requirement for a concise explanation of non-English language information would not be satisfied by a statement that a reference was cited in the prosecution of a United States application which is not relied on under 35 U.S.C. 120.

If information cited or submitted in a prior application relied on under 35 U.S.C. 120 was not in English, a concise explanation of the relevance of the information to the new application is not required unless the relevance of the information differs from its relevance as explained in the prior application.

The concise explanation may indicate that a particular figure or paragraph of the patent or publication is relevant to the claimed invention. It might be a simple statement pointing to similarities between the item of information and the claimed invention. It is permissible but not necessary to discuss differences between the cited information and the claims.

Applicants may, if they wish, provide a concise explanation of why English-language information is being submitted and how it is understood to be relevant. Concise explanations are helpful to the Office, particularly where documents are lengthy and complex and applicant is aware of a section that is highly relevant to patentability. or where a

large number of documents are submitted and applicant is aware that one of more are highly relevant to patentability.

C. EXAMINER HANDLING OF INFORMATION DISCLOSURE STATEMENTS

Information disclosure statements will be reviewed for compliance with the requirements of 37 CFR 1.97 and 1.98 as discussed in A and B above. Applicant will be notified of compliance and noncompliance with the rules as discussed below.

* * *

C(2) Complying Statements

The information contained in information disclosure statements which comply with both the content requirements as discussed in A above and the requirements based on the time of filing the statement as discussed in B above will be considered by the examiner.

Applicants, patent owners, reexamination requesters, protestors, and others are encourage to use form PTO-1449, "Information Disclosure Citation," when preparing an information disclosure statement. A copy of this form is reproduced in this section to indicate how the form should be completed. This form will enable persons to comply with the requirement to list each item of information being submitted and to provide the Office with a uniform listing of citations and with a ready way to indicate that information has been considered. Examiners must consider all citations submitted in conformance with the rules and this section; and their initials when placed adjacent to the considered citations on the list or [600-99] in the boxes provided on a form PTO-1449 provides a clear record of which citations have been considered by the Office. The examiner must also fill in his or her name and the date the information was considered in blocks at the bottom of the PTO-1449 form. If the citations

are submitted on a list other than on a form PTO-1449, the examiner may write "all considered" and his or her initials to indicate that all citations have been considered. If any of the citations are considered, a copy of the submitted list or form PTO-1449, as reviewed by the examiner, will be returned to the applicant with the next communication. Those citations not considered by the examiner will have a line drawn through the citation and any citations considered will have the examiners initials adjacent thereto. The original copy of the list or form PTO-1449 will be entered into the application tile. The copy returned to applicant will serve both as acknowledgement of receipt of the information disclosure statement and as an indication as to which references were considered by the examiner. Forms PTO-326 and PTO-37 include a box to indicate the attachment of form PTO-1449.

Information which complies with requirements as discussed in this section but which is in a non-English language will be considered in view of the concise explanation submitted (A(3) above) and insofar as it is understood on its face; e.g., drawings, chemical formulas, in the same manner that non-English language information in Office search files is considered by examiners in conducting searches. The examiner need not have the information translated unless it appears to be necessary to do so. The examiner will indicate that the non-English language information has been considered in the same manner as consideration is indicated for information submitted in English. The examiner should not require that a translation be filed by applicant. The examiner should not make any comment such as that the non-English language information has only been considered to the extent understood, since this fact is inherent.

Since information is required to be submitted in a separate paper listing the citations rather than in the specification. there is no need to mark "All Checked" or "Checked" in the margin of a specification containing citations.

If a statement fails to comply with requirements as discussed in this section for an item of information, a line should be drawn through the citation to show that it has not been considered. The other items of information listed that do comply with the rules and this section will be considered by the examiner and will be appropriately initialed.

C(3) Documents Submitted As Part of Applicant's Response to Office Action

Occasionally, documents are submitted and relied on by an applicant when responding to an Office action. These documents may be relied on by an applicant, for example, to show that an element recited in the claim is operative or that a term used in the claim has a recognized meaning in the art. Documents may be in any form but are typically in the form of an affidavit, declaration, patent, or printed publication.

To the extent that a document is submitted as evidence directed to an issue of patentability raised in an Office action, and the evidence is timely presented, applicant need not satisfy the requirements of 37 CFR 1.97 and 1.98 in order to have the examiner consider the information contained in the document relied on by applicant. In other words, compliance with the information disclosure rules is not a threshold requirement to have information considered when submitted by applicant to support an argument being made in a response to an Office action.

At the same time, the document supplied and relied on by applicant as evidence need not be processed as an item of information that was cited in an information disclosure statement. The record should reflect whether the evidence was considered, but listing on a form (e.g., PTO-892 or PTO-1449) and appropriate marking of the form by the examiner is not required.

For example, if applicant submits and relies on three patents as evidence in response to the first Office action and

also lists those patents on a PTO-1449 along with two journal articles, but does not file a certification or $200 fee, it would be appropriate for the examiner to indicate that the teachings relied on by applicant in the three patents have been considered, but to line through the citation of all five documents on the PTO-1449 and to inform applicant that the information disclosure statement did not comply with 37 CFR 1.97(c).

APPENDIX P

(MPEP § 901.05(d))

901.05(d) Translation

Examiners may consult the translators in the Translation Branch of the Scientific and Technical Information Center (STIC) for oral assistance in translating foreign patents or literature that are possible references for an application being examined. Examiners may also request written translations of pertinent portions of references being considered for citation or already cited in applications. (See MPEP § 901.06(a) Translations and MPEP § 903.03, Classification of Foreign Patents.)

Examiners can request written translations at any point in the examination process, at the discretion of the individual examiner, but are encouraged to use oral assistance and/or language reference resources as much as possible in the early phases of examination.

Equivalent versions of foreign specifications, that is, members of the same patent family, are often available in English or other languages known to the examiner. In addition, copies of previously translated documents are stored in the Translation Branch. Before any translation request is processed, the staff of the Translation Branch checks for equivalents or previous translations. The staff of STIC's Foreign Patents Branch or the Translation Branch can assist examiners in locating equivalents or abstracts. (See MPEP § 901.06(a), STIC Services—Foreign Patent Services.)

APPENDIX Q

(MPEP § 901.06(a))
(Pertinent Text)

901.06(a) Scientific and Technical Information Center (STIC)

The Scientific and Technical Information Center, formerly known as the Scientific Library, is located at CP3/4. Room 2C01. The ST1C maintains three additional satellite information centers: the Biotechnology/Chemical Library in CMI, Room 1C19, the Electronic Information Center in CPK2, Room 4B40, and the Patent Law Library in CPK1, Room 568.

35 U.S.C. 8. Library.

The Commissioner Shall maintain a library of scientific and other works and periodicals, both foreign and domestic, in the Patent and Trademark Office to aid the officers in the discharge of their duties.

Technical literature, foreign patent documents, and reference and online search services available in the Scientific and Technical information Center (STIC) are all important resources for the patent examiner to utilize. These resources provide material which must be known or searched to determine whether claims of applications are directly anticipated and therefore unpatentable under the provisions of 35 U.S.C. 102. STIC handbooks, textbooks, periodicals, reports, and other materials assist examiners in deciding the question of patentable invention in cases in which the primary search indicates that there is some novelty as compared to any single reference in the art (35 U.S.C. 103). These resources enable the examiner to determine whether the features novel in the particular combination searched would be obvious to a person skilled in the art from the general state of knowledge as reflected in the technical literature.

STIC COLLECTIONS

* * *

3. Foreign Patent Documents

The United States Patent and Trademark Office receives foreign patent documents through exchange agreements with almost all countries that print their patent documents. This makes STIC's collection of foreign patent documents the most comprehensive in the United States.

The collection is located in the Foreign Documents Division. The most current part of the collection is made available to examiners and the public through the Foreign Patent Access System (FPAS), a CD-ROM—based local area network in STIC that allows users to look up, view and print documents. The documents from the major industrial countries for the period 1969 to 1990 are found on 16 mm microfilm in the Microfilm Room. The earliest patent documents, back as far as 1617, and documents from smaller countries arc found in the paper collection in the stacks or at remote sites.

Most foreign countries issue official patent and trademark journals corresponding to the *Official Gazette of the United States Patent and Trademark Office*. These journals are shelved under country name. Most countries issue name indexes: some also issue classified indexes. Indexes are shelved with the journals. Much of the index information is also available on FPAS.

The official journals of a few countries include abstracts of the disclosures of the patents announced or applications published.

In addition, the Foreign Patents Branch acquires English language abstracts of foreign patent documents for selected countries published by Derwent. Holdings are in 16mm format from 1972 to date. Earlier holdings are in paper. The

Branch also has unexamined Japanese patent applications abstracted by the Japanese Patent Office, the Patent Abstracts of Japan, from 1977 to date in paper.

Many countries; e.g., China, are providing abstracts of their patent documents on CD-ROM. These abstracts will also be accessible through FPAS.

Many technical abstracting publications include patent literature; the most notable of these is Chemical Abstracts. The annual indexes of Chemical Abstracts include, in addition to the subject matter index, an author index in which the patentee's and inventor's names appear, and patent number lists; corresponding patents of different countries are identified. Specifications of unprinted, or as yet unprinted, patents may be included in some of these abstracting services.

* * *

STIC SERVICES

1. Reference Services

The staff of the Scientific Reference Branch, the Electronic Information Center, the Patent Law Library, and the Biotechnology/Chemical Information Branch assist examiners in the use of the STIC. Upon request, they provide guidance on finding information in the collection. If any problems are encountered in locating materials, using the catalogs or indexing services, or finding answers to informational needs, please check with the staff. They are ready and willing to assist. Queries may be made in person or by telephone.

2. Online Searching

Online computer data base searching is provided by the Scientific Reference Branch, the Electronic Information Center, the Patent Law Library, and the Biotechnology/Chemical Information Branch. All branches have access via modems or the in-house system to a number of

vendors' commercial data base search systems. These vendors' databases extensively cover the field of knowledge and make it possible for online searchers to retrieve bibliographic information with abstracts, chemical structures, DNA sequences, and some-times the full text of the articles, depending on the data-base. This online search service provides a valuable screen of the nonpatent literature for the examiner intending to make a search of the secondary sources of his/her area of interest.

Vendors accessed by STIC staff include DIALOG, ORBIT, DOE/RECON, Chemical Abstracts Services (STN), INPADOC, DataTimes, DATASTAR, DTIC/DROLS, IntelliGenetics, and Mead Data Central. When they are identified as meeting the needs and requirements of the Office, new data base vendors are added. A list of the data bases offered by each vendor is available in the vendors' manuals located in each STIC branch. Examiners may request a computer search by submitting a request form to the appropriate branch. Searches arc usually completed and ready for pickup within 1-2 days.

Examiners are allowed to conduct searches of online commercial databases independently of STIC staff. Training is provided through the Patent Academy and individual assistance is available from the STIC staff, especially for searching chemical structures and DNA sequences.

Online searching of nucleic and amino acid sequences is conducted by the staff of the Biotechnology/Chemical Information Branch through the use of an in house computer network developed for this purpose. Examiners who wish to access the Automated Biotechnology Sequence Search (ABSS) system located in Group 1800 must apply through their SPE to the Biotechnology/Chemical System Branch for an ID and password. On an as needed basis, introductory classes are conducted by STIC staff to assist examiners in understanding the sequence search results.

3. Foreign Patent Services

The staff of the Foreign Patents Branch of the Foreign Document Division is available to assist with any problem or informational need regarding foreign patent searching or foreign patent documents.

Online search services on Orbit/Questel and Dialog (on the basis of Derwent databases) or INPADOC are performed for patent examiners by the Foreign Patents Branch. The services provided include: identification of English-language or preferred-language equivalents; determination of priority dates and publication dates; searches by inventor name or abstract number; other patent family and bibliographic searches; and foreign classification information.

Examiners who choose to perform their own patent searches after receiving appropriate training through the Patent Academy can consult foreign patent experts for difficult searches. In using the Derwent versus the INPADOC databases, examiners should be aware that the systems overlap in coverage and have other similarities. but also differ in format, kinds of searches that can be performed. and patent document and country coverage. Derwent maintains superior coverage of chemical patent documents, while INPADOC includes earlier documents and more countries and has more extensive coverage of mechanical and electrical patent documents than Derwent databases.

The staff of the Foreign Patents Branch can supplement the online searching effort with manual searches of foreign patent journals. including *Official Gazette(s),* patent concordances, and/or indexes. The staff also provides training in the use of the Foreign Patents Access System (FPAS) and information of use of the foreign patent collections.

SPECIAL NOTE: Members of the public can order copies of foreign patent documents. Procedures are outlined in a

brochure entitled, "Foreign Patent Document Copy Orders" available in STIC.

4. Translations

Examiners may consult the translators in the Translations Branch of STIC's Foreign Document Division for oral assistance in translating foreign language patents and other literature sources that are possible references for applications being examined. Oral translations are performed for the major European languages and for Japanese. Examiners may also request written translations of pertinent portions of references being considered for citation or already cited in applications. Full translations are also made upon request. Written translations can be made from virtually all foreign languages into English.

There is a computerized database located in the Translations Branch listing all translations which have been made by the Branch, and a few others gathered from miscellaneous sources. This database lists over 30,000 translations of foreign patents and articles, all of which are located in the Translations Branch. Patent translations are indexed by country and patent number; articles are indexed by language and author or title. Any copies of translations coming to examiners from outside the Office should be furnished to the Translations Branch so that it may make copies for its files.

APPENDIX R

SEL's INFORMATION DISCLOSURE STATEMENT ("IDS")

'636 IDS

Docket: 0756-1354

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit: 2503
Examiner: Team 5
Date: November 15, 1995

In re PATENT application of
Shunpei YAMAZAKI et al.
Serial No. 08/473.953
Filed; June 7, 1995
For: INSULATED GATE FIELD EFFECT TRANSISTOR AND ITS MANUFACTURING METHOD

INFORMATION DISCLOSURE STATEMENT

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

In accordance with the provisions of 37 C.F.R. 1.56 and 37 C.F.R. 1.97, 1.99. Applicant submits herewith attached Form PTO-1449 listing references known to Applicant and request that these references be made of record in the above identified application. Copies of the references listed are submitted herewith in accordance with 37 C.F.R. 1.98(a). A $210.00 fee in accordance with 37 C.F.R. § 1.17(p) is attached.

Particularly, the following references have come to the attention of Applicant and Applicant hereby requests that these references be made of record in the above identified application.

U.S. Patent 4,460,670 isssued to Ogawa.
U.S. Patent 4,418,132 issued to Yamazaki.
U.S. Patent 4,420,872 issued to Solo de Zaldivar.
U.S. Patent 4,690,717 issued to Yamazaki.
U.S. Patent 4,889,782 issued to Yamazaki.
U.S. Patent 4,889,783 issued to Yamazaki.
Japanese Patent Laid-Open No. 4-49,269.
Japanese Patent Laid-Open No. 55-011329.
Japanese Patent Laid-Open No. 55-029154.
Japanese Patent Laid-Open No. 55-50,663.
Japanese Patent Laid-Open No. 55-50,664.
Japanese Patent Laid-Open No. 57-13,777.
Japanese Patent Laid-Open No. 58-92,217.
Japanese Patent Laid-Open No. 58-155773.
Japanese Patent Laid-Open No. 58-155774.
Japanese Patent Laid-Open No. 58-161380.

Matsumura Japanese Journal of Applied Physics. *(Invited) Amorphous Silicon Transistors and Integrated Circuits.* 1983.

P.C. LeComber. Electronics Letters. *Amorphous-Silicon Field-Effect Device and Possible Application.* 3/15/79.

K. Roy. IEEE Electron Device Letters 1980, and *Affidavit of Chuang Chuang Tsai.*

A brief explanation of the following references not in the English language are further provided to aid in the consideration of these documents. Japanese Patent Laid-Open No. 55-011329 (the inventor named in this laid-open is the same as the applicant for the subject application) was laid-open on January 26, 1980, and teaches that in order to control the Eg of semiconductor layers, oxygen, nitrogen and carbon

is implanted by ion implantation at a concentration of 10^{13} to 10^{22} cm^3, for example, a concentration of 10^{13} cm^3. Japanese Patent Laid-Open No. 55-029154 (the investor named in this laid-open is the same as the applicant for the subject application) was laid-open on March 1, 1980, and teaches that in a junction between two semiconductor layers having different energy band gaps, the band gap is monotonically changed by changing the amount of added impurity (carbon, nitrogen or oxygen) within a concentration range of 10^{25} to 10^{22} cm^3. Thus, both of the foregoing '329 and '154 laid-open is directed to the addition of the impurities rather than the reduction thereof as is the case in the claims of the subject application. Furthermore, these laid-open's are not directed to the specific device structures of the claims of the subject application.

Japanese Patent Laid-Open No. 58-155773 (the inventor named in this laid-open is the same as the applicant for the subject application) was laid-open on September 16, 1983, and shows a semiconductor device formed by laminating semiconductor layers by a multi-chamber system, wherein the concentration of carbon, nitrogen or oxygen in the semiconductor layers is reduced to 3×10^{17} cm^{-3} or lower. Japanese Patent Laid-Open No. 58-155774 (the inventor named in this laid-open is the same as the applicant for the subject application) was laid-open on September 16, 1983, and shows a photoelectric conversion device having laminated semiconductor layers of a different conductivity type, wherein the concentration of carbon, nitrogen or oxygen in the semiconductor layers is reduced to 3×10^{13} cm^{-3} or lower. Japanese Patent Laid-Open No. 58-161380 (the inventor named in this Laid-Open is the same as the applicant for the subject application) was laid-open on September 24, 1995, and shows semiconductor device having laminated semiconductor layers wherein the concentration of carbon, nitrogen or oxygen in the semiconductor layers as measured by IMA (SIMS) is 3×10^{13} cm^{-3} or less. With respect to the

foregoing '773, '774, and '380 laid-opens, it is submitted that. although they are directed to high purity semiconductor, they, like Japanese Laid-Open No. 59-35488 already discussed in allowed parent application Serial No. 08/425,455, are not directed to the specific structure of the semiconductor device as recited in the claims. Accordingly, the '773, '774, and '380 references are not any more relevant than the '488 reference.

Furthermore, the following Japanese Patents disclose the use of silicon nitride for a gate insulating layer of a thin film transistor: 56-135968, 55-50663 and 55-50664.

Japanese Patent Laid-Open No. 57-13,777 teaches the use of a nitrided surface of a semiconductor as a gate insulating layer for a TFT.

Additionally, Japanese Patent Laid-Open No. 56-135968 and the following reference that were noted in an Japanese Opposition against that patent have also come the attention of Applicant and Applicant hereby requests that these references be made of record in the present application.

Japanese Patent Laid-Open No. 56-135968 and Opposition References

Applicant notes the Japanese Patent Laid-Open No. 56-135968 and the following references that were noted in an Japanese Opposition against that patent. A partial translation of this patent and of the references not in the English language is further provided to aid in the consideration of these documents. Japanese Patent Laid-Open No. 56-135968 was filed in Japan on March 27, 1980 and was published on October 23, 1981. Applicant is not aware of any corresponding U.S. patents equivalent to this Japanese application. Copies of these references are provided and Applicant requests that these references be considered and made of record in the present application.

(1) Philosophical Magazine, 1976. Vol. 33. No. 6, 935-949 "Electronic Properties of Substitutionally Doped Amorphous Si and Ge", W.E. Spear et al., 1976.

(2) Physics of Semiconductor Devices, pages 568-621; S.M. Sze. 1969.

(3) Applied Physics Letters, Vol. 34, pp 234-236. "Electronic Density of States in Discharge-Produced Amorphous Silicon", M. Hirose et al., 2/1/79.

(4) Extended Abstracts (The 40th Autumn Meeting) The Japan Society of Applied Physics, page 325, 30P-S-17. Nakamura et al., 9/79.

(5) Proceedings of the 10th Conference on Solid State Devices. JAP. Vol. 18, p 109-113. "Determination of Localized State Density Distribution in Glow Discharge Amorphous Silicon." Hirose et al., 1979.

(6) ExtendedAbstracts (The 40th Autumn Meeting) The Japan Society of Applied Physics. page 326, 3OP-S18. Matsumura et al., 1979.

(7) A Journal of Theoretical Experimental and Applied Physics. "Localized States in the Mobility Gap of Amorphous Quartz and Glass", page 839-851. Anderson, 1974.

(8) Physics of Semiconductor Devices, page 32, S.M. Sze. 1981.

(9) National Convention Record. The Institute of Electronics and Communication Engineers of Japan. 2-281-282. Matsumura et al., 3/80.

(10) Proc. 7th Intern. Vac. Congr. & 34d Intern. Conf. Solid Surfaces "Preparation and Reliability of Thin Film Transistors Based on CdSe", M.J. Lee, 1979.

(11) Solid State Communications, Vol. 17, No. 9, pp. 1193-1196 "Substitutional Doping of Amorphous Silicon", Spear et al., 1975.

(12) National Convention Record. The Institute of Electronics and Communication Engineers of Japan. 2-287-288. Matsumura et al., 3/80.

(13) The Transactions of The Institute of Electronics and, Communication Engineers of Japan. Vol. 363-C No. 2 pp. 128-129. "Amorphous Silicon Thin Film MOS Transistors". Matsumura et al., 2/80.

(14) National Convention Record. The Institute of Electronics and Communication Engineers of Japan. 2-285-286. Matsumura et al., 3/80.

(15) Extended Abstracts (The 26th Spring Meeting) The Japan Society of Applied Physics and Related Societies, page 326. Matsumura et al., 3/79.

(16) Optoelectronics, Vol. 4, No. 2, pp 209-222. "Active Matrix Addressed Liquid Crystal Displays Using Amorphous Silicon Thin Film Transitors. Ibaraki et al., 12/89.

(17) Journal of Non Crystalline Solids 8-10, 727-738. "Investigation of the Localized State Distribution in Amorphous Si Fllms". Spear et al., 1972.

(18) Electronics Letters, Vol. 15, No. 6, 179-181. "Amorphous-Silicon Field-Effect Device and Possible Application. Le Comber. 3/79.

(19) Extended Abstracts (The 26th Spring Meeting) The Japan Society of Applied Physics and Related Societies, page 143, 27P-E-15. Suzuki et al., 1978.

(20) Japanese Patent Laid-Open No. 54-152894. Ohtake. 12/1/79.

(21) U.S. Patent No. 4.055.884, Jambotkar. 12/13/76, and

(22) U.S. Patent No. 3.999.212. Usuda, 3/4/68

Applicant further provides the following comments to assist the Examiner in considering the information cited therein.

Specifically, with respect to this section ertitled *Japanese Patent Laid-Open No. 56-135968 and Opposition References* the following concise statement of relevance as it is presently understood by the person most knowledgable about the contents of several documents not in the English language is provided to facilitate consideration of these documents by the Examiner.

Specifically, reference (4) to Nakamura entitled *Extended Abstracts (The 40th Autumn Meeting) The Japan Society of Applied Physics* discloses a TFT having a silicon gate and an amorphous silicon channel layer, reference (15) to Matsumura entitled *Extended Abstracts (The 26th Spring Meeting) The Japan Society of Applied Physics and Related Societies* discloses a fabrication method of a TFT in which a surface of a single crystalline silicon substrate (functioning as a gate) is thermally oxidized to form a gate oxide, as N layer is then deposited and patterned as a channel layer, and n+ layers are then formed as source and drain; and Japanese Patent Laid Open No. 54-152894 (Reference 20) to Ohtake discloses a TFT having a glass substrate 401, drain 403, source 404, gate insulator 405 and gate electrode 406. It is further noted that reference (15), which is not in English is exactly the same as reference (6), which is in English.

With respect to several of the other documents in the section entitled *Japanese Patent Laid-Open No. 56-135968 and Opposition References* the following comments are further offered to assist the Examiner in his review thereof. The Examiner's attention is particularly directed to Reference (18) to Le Comber et al., which appears to disclose the use of a silicon nitride layer as a gate insulating layer.

Reference (9) to Matsumura teaches the use of a non-doped amorphous silicon layer (n-layer) as a channel layer, but does not teach the formation of source and drain semiconductor regions. Reference (12) to Matsumura teaches a TFT having a non-doped i-type amorphous silicon film formed on a glass substrate, n+ layers as source and drain regions formed on the i-type silicon film and a silicon oxide (SiO_2) layer as a gate insulating layer.

References (13) and (14) to Matsumura shows a TFT of which structure appears to be the same as that disclosed in references (6) and (15). Reference (13) appears to be directed to a case in which the channel region is non-doped.

Reference (16) to Ibaraki et al. is dated December 1989 so it is not believed to be available as prior art. In any event, this reference appears to disclose the use of a silicon nitride layer as a gate dielectric layer. Reference (19) to Suzuki et al. discloses a TFT having an n-type a-Si channel layer and n+ source and drain regions. Reference (20) to Ohtake discloses a TFT having a glass substrate, drain, source, gate insulator and gate electrode.

Cross Reference to Related Applications

The present application includes a number of related applications which are discussed in greater detail below, and Applicant requests that the references which have been made of record in these related applications be considered in the present application. Applicant has attempted to organize this information to facilitate review by the Examiner and will promptly provide any additional information that the Examiner believes will facilitate consideration and review of these references.

Specifically, the present application is a divisional of Serial No. 08/425,455, filed April 20, 1995 (allowed), which was a continuation of Serial No. 08/214,494 filed March 18, 1994

(abandoned), which was a divisional of Serial No. 07/987,179 filed December 8, 1992 (now U.S. Patent No. 5,315,132), which was a divisional of Serial No. 07/885,643 filed May 19, 1992 (abandoned), which was a divisional of Serial No. 07/707,178 (now U.S. Patent No. 5,142,344), which was a continuation of Serial No. 07/520,756 filed May 9, 1990 (now abandoned), which was a divisional of Serial No. 07/153,477 filed February 3, 1981 (now U.S. Patent No. 4,959,700), which was a continuation of Serial No. 06/735,697 filed May 20, 1985 (now abandoned).

Additionally, Serial No. 735,697 included another divisional application. Serial No. 06/912,498, which issued as U.S. Patent No. 4,727,044. Furthermore, Serial No. 07/885,643 included another divisional application. Serial No. 07/987,160 filed December 8, 1992 (now abandoned), which included a continuation application. Serial No. 08/386,187 filed February 9, 1995 (currently pending), and the '643 application also included a continuation application. Serial No. 08/171,769 filed December 22, 1993 (currently being appealed). Additionally, Serial No. 987,179 included another divisional application. Serial No. 08/214,550 filed March 18, 1994 (now abandoned), which included a continuation application. Serial No. 08/426,487 filed April 20, 1995 (currently pending).

Applicant understands that many of the references of record in these applications should have already been considered by the Examiner in the present application pursuant to M.P.E.P. § 609 which states:

> Information which is cited or submitted to the Office in the parent application of a file wrapper continuing application under 37 CFR § 1.62 will be part of the file before the examiner and need not be resubmitted in the continuing application. Likewise, the examiner will consider information cited or submitted to the Office in a parent application when examining a continuing

application, and a list of the information need not be submitted in the continuing application unless applicant desires the information to be printed on the patent.

In accordance with the last portion of this statement, Applicant wishes to ensure that all references considered by the Examiner in the present application are printed on any patent that issues from this application. A list of the information cited or submitted to the Office in the above-listed related applications is submitted herewith in order to comply with this provisions of § 609 of the M.P.E.P. to ensure printing on any issued patent.

Applicant also notes 37 C.F.R. § 1.98(d) that provides that copies of information are not required if that information was previously cited by or submitted to the Office in a prior application, provided that the prior application is properly identified in the statement and relied upon for an earlier filing date under 35 U.S.C. § 120. For a number of the related applications discussed below, it is noted that the present application relies upon these applications for an earlier filing date under 35 U.S.C. § 120 and therefore copies of the references in these applications are not submitted in accordance with 37 C.F.R. § 1.98(d).

The above-described family of related applications will now be discussed in further detail.

Related Application Serial No. 08/425,455

The references listed below have been cited to the Patent Office in a form PTO-1449 or cited by the Patent Office in a PTO-892 during the prosecution of Application Serial No. 08/425,455, from which the '953 application is a Rule 60 divisional. Accordingly, these references should have been considered by the Examiner and are listed herein to ensure their printing on the front of any patent that issues in the present application. Copies of these references are not required in accordance with 37 C.F.R. § 1.98(d) in that the

present application relies upon this application for an earlier filing date under 35 U.S.C. § 120.

U.S. Patent 3,304,469 issued to Weimer.
U.S. Patent 4,072,974 issued to Ipri.
U.S. Patent 4,113,514 issued to Pankove.
U.S. Patent 4,196,438 issued to Carlson.
U.S. Patent 4,239,554 issued to Yamazaki.
U.S. Patent 4,263,057 issued to Ipri.
U.S. Patent 4,272,880 issued to Pashley.
U.S. Patent 4,353,085 issued to Sakurai.
U.S. Patent 4,377,902 issued to Shinada et al.
U.S. Patent 4,406,709 issued to Celler.
U.S. Patent 4,459,739 issued to Shepherd et al.
U.S. Patent 4,463,492 issued to Maeguchi.
U.S. Patent 4,466,171 issued to Jochems.
U.S. Patent 4,468,855 issued to Sasaki.
U.S. Patent 4,470,060 issued to Yamazaki.
U.S. Patent 4,476,485 issued to Naem et al.
U.S. Patent 4,514,895 issued to Nishimura.
U.S. Patent 4,523,368 issued to Feist.
U.S. Patent 4,578,304 issued to Tanaka et al.
U.S. Patent 4,591,892 issued to Yamazaki.
U.S. Patent 4,611,220 issued to MacIver.
U.S. Patent 4,619,034 issued to Janning.
U.S. Patent 4,667,217 issued to Janning.
U.S. Patent 4,727,044 issued to Yamazaki.
U.S. patent 4,766,477 issued to Nakagawa et al.
U.S. Patent 4,959,700 issued to Yamazaki.
U.S. Patent 5,142,344 issued to Yamazaki.
Japanese Patent Laid-Open No. 56-135,972.
Japanese Patent Laid-Open No. 59-35,423.
Japanese Patent Laid-Open No. 59-35,488.
Japanese Patent Laid-Open No. 59-72,128.
Japanese patent Laid-Open No. 59-72,182.

R.A. Lemons et al., *Laser Crystallization of Si Films on Glass*. Appl. Phys. Lett. Vol. 40, No. 6, March 15, 1982, pp. 469-471.

C.C. Tsai, Journal of Non-Crystalline Solids. *Amorphous Si Prepared in a Ubv Plasma Deposition System*, Dec. 1983.

G. Yaron & L.D. Hess, *Application of laser appealing techniques to increase channel mobility in silicon on sapphire transistor*. Appl. Phys. Letts. Vol. 36, No. 6, 1 Feb. 1980, pp. 220-222, and

T.I. Kamins, IEEE Electron Device Letters, *MOSFET's in Laser-Recrystallized Poly-Silicon on Quartz*. Oct. 1980.

Related Application Serial No. 06/735,697

The following references have been cited to the Patent Office in a form PTO-1449 or cited by the Patent Office in a PTO-892 during the prosecution of Application Serial No. 06/735,697, from which the 07/153,477 application was a Rule 62 continuation. Accordingly, these references should have been considered by the Patent Office and printed on any patent issuing from the present application in accordance with M.P.E.P. § 609. Copies of these references are not required in accordance with 37 C.F.R. § 1.98(d) in that the present application relies upon this application for an earlier filing date under 35 U.S.C. § 120.

U.S. Patent 4,598,304 issued to Tanaka.

Related Applications Serial Nos. 07/687,745 and 08/054,842.

As noted above, in addition to continuation application Serial No. 07/707,178 (which led to the present application) of application Serial No. 07/520,756, another divisional of the '756 application was filed as Serial No.07/687, 745. The '745 application was further abandoned in favor of Rule 62 continuation filed as Serial No. 08054842 which issued as U.S. Patent 5,313,077, Therefore the following references

which were cited to the Patent Offices is a form PTO-1449 or cited by the Patent Office is a PTO-892 during the prosecution the '745 and '842 applications are provided herein for consideration by the Examiner. Copies of the references in accordance with 37 C.F.R. § 1.98 are also enclosed.

U.S. Patent 4,823,180 isssued to Weider.

Related Applications Serial Nos. 07/987,160 and 08/386,187

As noted above, in addition to divisional application Serial No. 07/987,179 (which led to the present application) of application Serial No. 07/885,643, another divisional of the '643 application was filed as Serial No. 07/987,160. The '160 application was further abandoned in favor of Rule 62 continuation filed as Serial No. 08/386,187. The '643 application was further abandoned in favor of Rule 62 continuation filed as Serial No. 08/171,769. Therefore, the following references which were cited to the Patent Office in a form PTO-1449 or cited by the Patent Office in a PTO-892 during the prosecution of the '160, '187 and '769 applications are provided herein for consideration by the Examiner. Copies of the references in accordance with 37 C.F.R. § 1.98 are also enclosed.

U.S. Patent No. 4,529,617 issued to Chenevas-Paule et al.

U.S. patent No. 5,315,132 issued to Yamazaki.

T. Unagami et al., *High-Voltage Silicon Thin Film Transistor*, IEEE, Dev. Lett. Vol. EOL-3, No. 6, June 1982, pp. 167-68, and

T. Stultzn et al., *Bearn Processing of Silicon with a Scanning CW Hg Lamp.* Laser Solid Interaction and Transient Thermal Processing of Materials. Materials Research Society Symposia Proceedings, Volume 13 (1983), pp. 463-476.

Related Applications Serial Nos. 08/214,550 and 08/426,487

As noted above, in addition to divisional application Serial No. 08/214,494 (which led to the present application) of application Serial No. 07/987,179, another divisional of the '179 application was filed as Serial No. 08/214,550. The '550 application was further abandoned in favor of Rule 62 continuation filed as Serial No. 08/426,487. Therefore, the following references which were cited to the Patent Office in a form PTO-1449 or cited by the Patent Office in a PTO-892 during the prosecution of the '550 and '487 applications are provided herein for consideration by the Examiner. Copies of the references in accordance with 37 C.F.R. § 1.98 are also enclosed.

U.S. Patent 4,220,483 issued to Cazcarra.
U.S. Patent 4,769,338 issued to Ovshinsky et al., and
U.S. Patent 5,094,963 isued to Hiraguchi et al.,
Ghandhi, *VLSI Fabrication Principle, Silicon & Gallium Arsenide*, 1983, pp. 23-29, and
C. Mager et al., "Investigations of the Hydrogen and Impurity Contents of Amorphous Silicon by Secondary Ion Mass Spectrometry", *Solar Cells*, Vol. 2 (1980), pp. 365-376.

Related Application Serial No. 08/350,169

The above '169 application, although not in the above-described family of related applications, is also related to the subject application and information from the above '169 application and its family are included in the information discussed hereinbefore.

As noted above, consideration of the information and documents discussed herein is requested. If the Examiner feels that any further discussions would expedite the prosecution of this application or requires any further information to fully consider the enclosed information, it is

requested that the undersigned be contacted so that such information can be promptly provided.

Other Related Applications

The following applications also contain similar subject matter to the subject application: Serial No. 08/396,780 (currently pending), Serial No. 08/310,364 (currently pending), Serial No. 08/213,837 (currently pending), Serial No. 08/183,800 (currently pending), Serial No. 08/095,172, Serial No. 07/853,690 (now issued as U.S. Patent No. 5,313,076).

Respectfully submitted,

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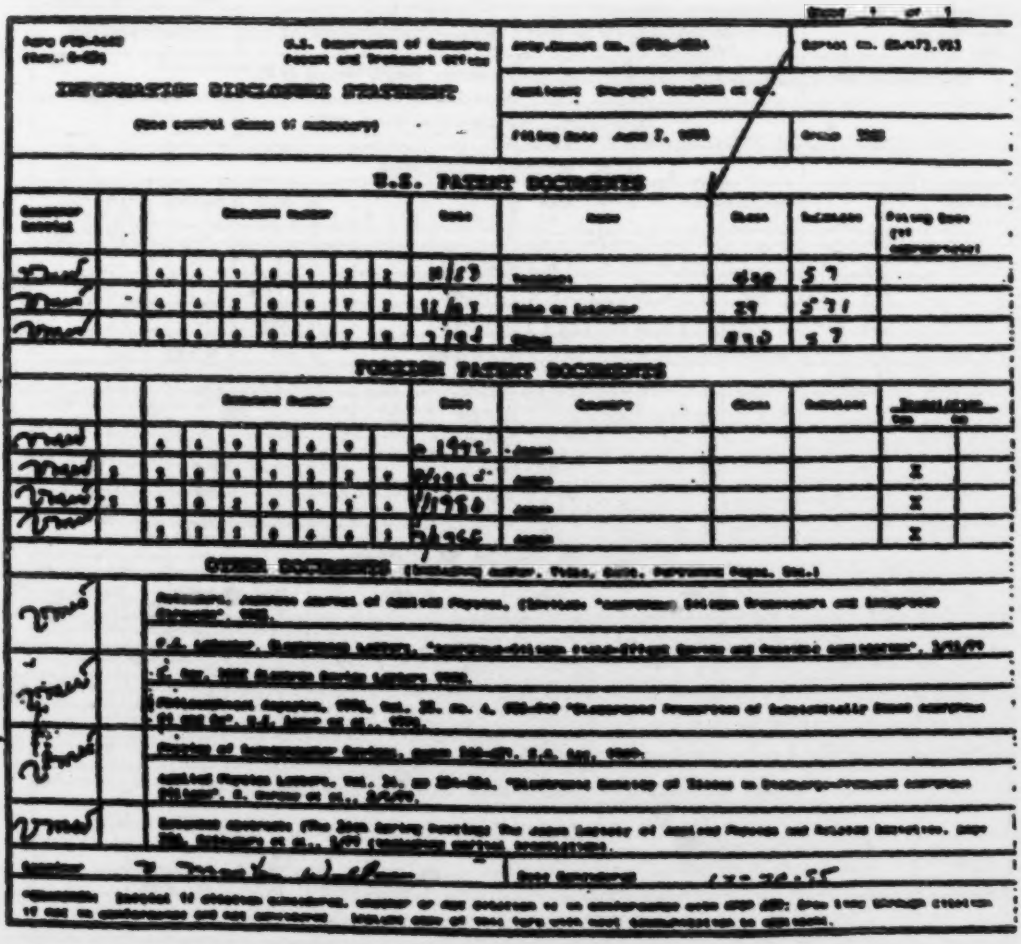

INFORMATION DISCLOSURE STATEMENT

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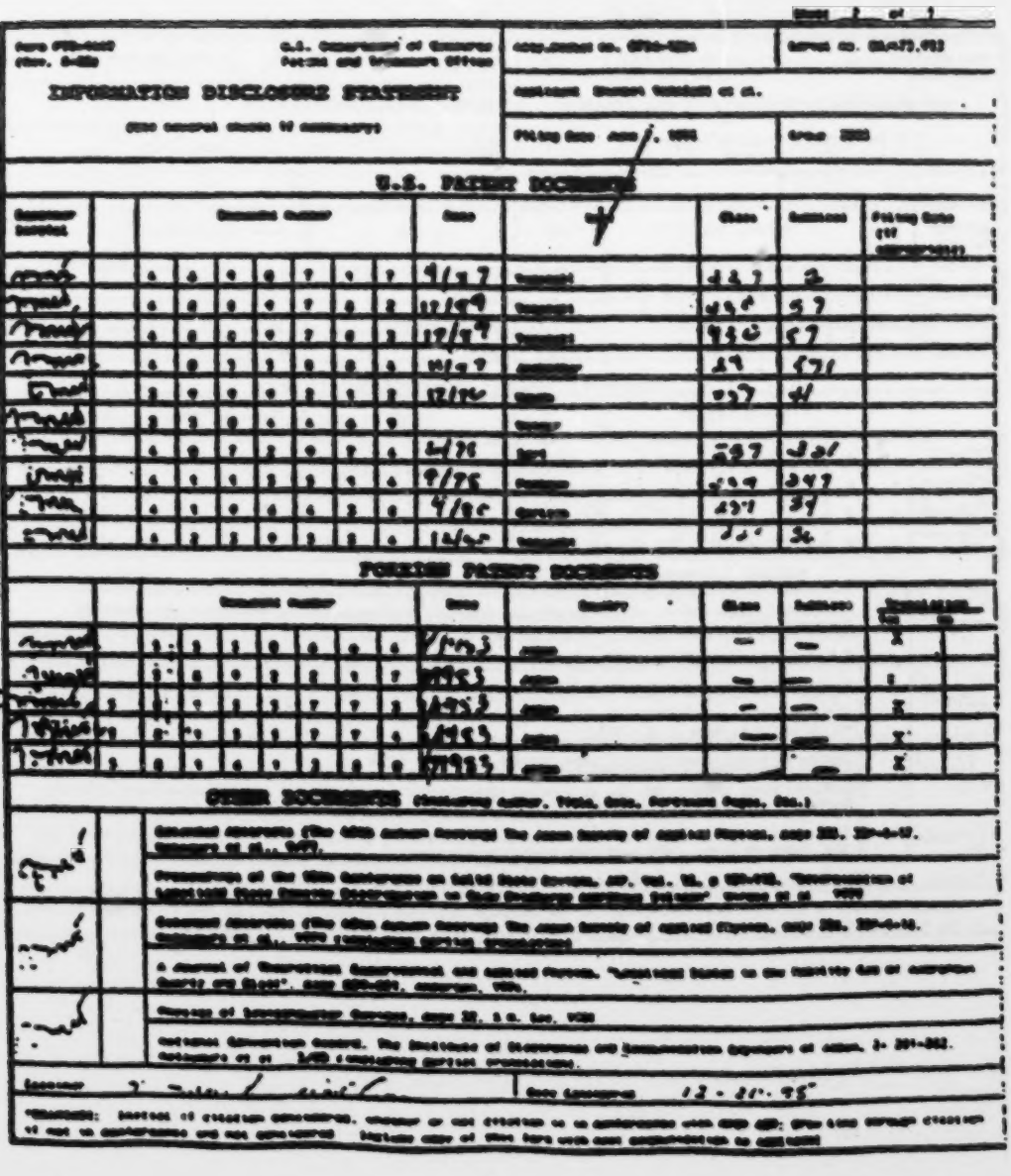

INFORMATION DISCLOSURE STATEMENT

U.S. PATENT DOCUMENTS

FOREIGN PATENT DOCUMENTS

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

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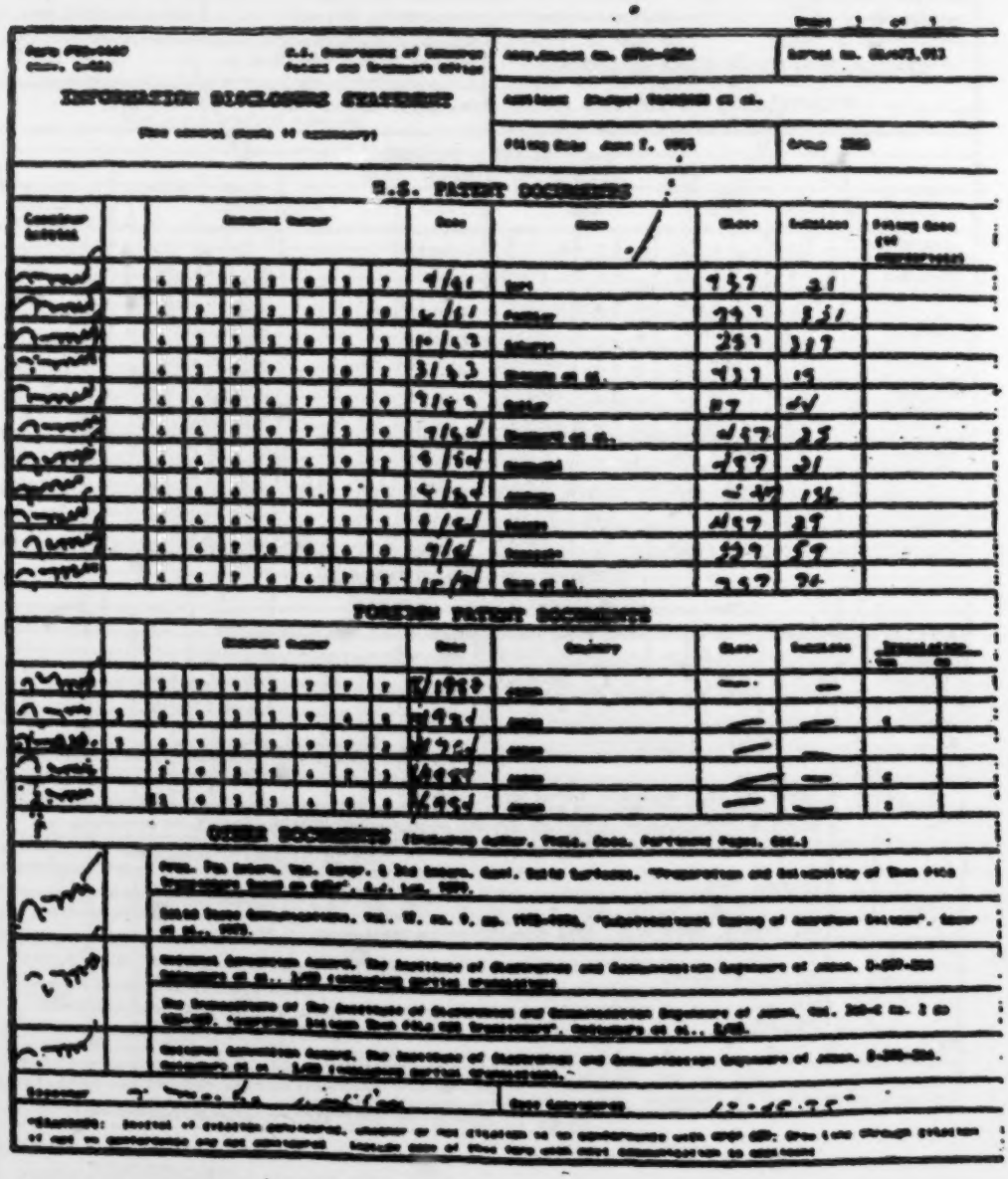

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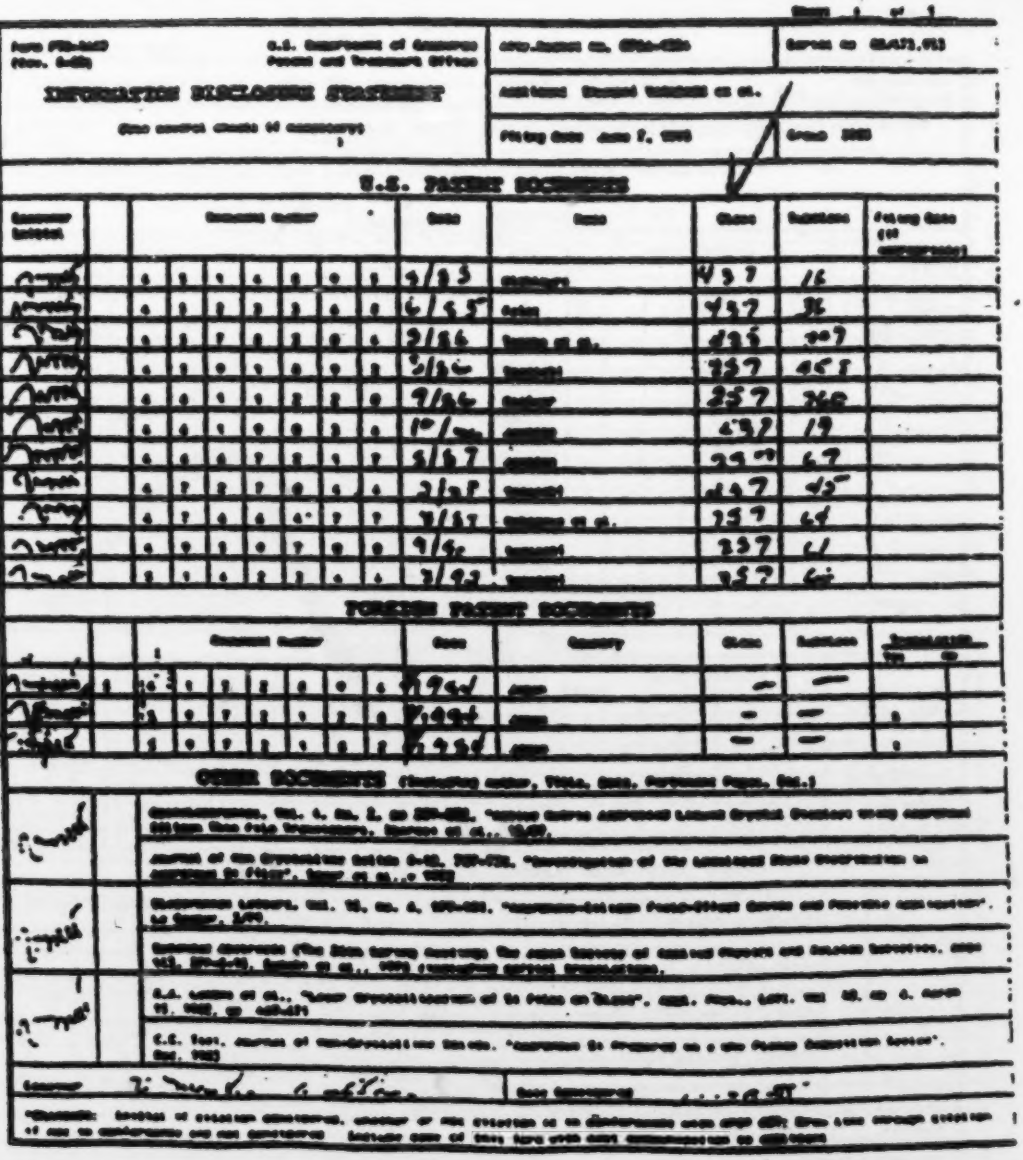

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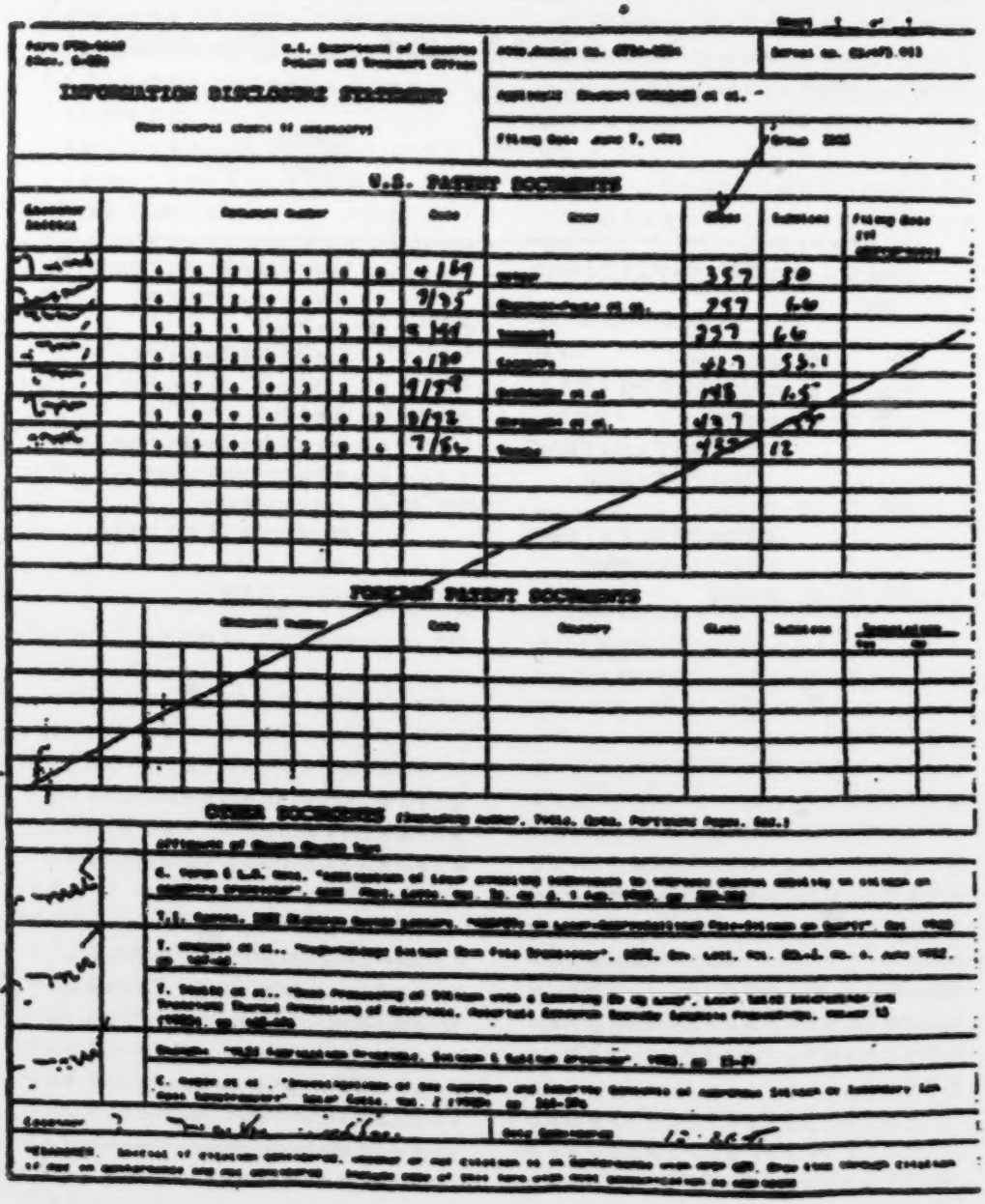

INFORMATION DISCLOSURE STATEMENT

U.S. PATENT DOCUMENTS

FOREIGN PATENT DOCUMENTS

OTHER DOCUMENTS

SEC 027894

APPENDIX S

(Canon '968 Patent)

⑲公開特許公報(A)　昭56—135968

⑤Int. Cl.³	識別記号	庁内整理番号	⑬公開　昭和56年(1981)10月23日
H 01 L 29/78		6603—5F	
29/04		7514—5F	

発明の数　3
審査請求　未請求

(全11頁)

⑭非晶質シリコン薄膜トランジスタ及びその製造法

⑳特　願　昭55—28251
㉒出　願　昭55(1980)3月27日

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明　細　書

1. 発明の名称

非晶質シリコン薄膜トランジスタ及びその製造法

2. 特許請求の範囲

(1) 水素化又は／及び弗素化の非晶質シリコンからなる半導体層、該層上に電気的な絶縁層を介して設けたゲート電極、該半導体層のクリーンサーフェスに互いに離されて互例に形成された非晶質シリコンを母体とする第1のn⁺層及び第2のn⁺層、第1のn⁺層上に形成されたソース電極、第2のn⁺層上に形成されたドレイン電極とで形成されていることを特徴とする非晶質シリコン薄膜トランジスタ。

(2) n⁺層の比抵抗値が10Ωcm以下である特許請求の範囲第1項の非晶質シリコン薄膜トランジスタ。

(3) 絶縁にし得る基板上に設けられ、ゲート電極と電気的な絶縁層とが形成されてなる非晶質シリコン薄膜トランジスタ形成用の基板上で、且つ前記絶縁層上に非単結晶質を所定の真空度にして形成又は／及び弗素化非晶質シリコンからなる半導体層を形成した後、引続き非晶質シリコンを母体とするn⁺層を形成する際、該n⁺層を2つの互いに離された第1のn⁺層と第2のn⁺層とに分離すること、その後、前記第1のn⁺層にソース電極を前記第2のn⁺層上にドレイン電極を形成することを特徴とする非晶質シリコン薄膜トランジスタの製造法。

(4) 半導体層を形成した後、該層を大気に対せずに引続いてn⁺層を形成する特許請求の範囲第3項の非晶質シリコン薄膜トランジスタの製造法。

(5) 半導体層が、シリコンと水素との化合物又は／及びシリコンと弗素との化合物のグロー放電による分解に基づいて形成される特許請求の範囲第3項の非晶質シリコン薄膜トランジスタの製造法。

(6) グロー放電を開始した後で半導体層とn⁺層とを連続的に形成する特許請求の範囲第4項の非晶質シリコン薄膜トランジスタの製造法。

(7) グロー放電放圧を一定にする特許請求の範囲第5項及び同第6項の非晶質シリコン薄膜トランジスタの製造法。

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(3) pn接合、非晶質シリコンを形成する化合物に、ほう素との化合物又は／及び周期表とほう素との化合物とを含有し、これらの化合物のグロー放電による分解について形成される特許請求の範囲第1項の非晶質シリコン薄膜トランジスタの製造法。

(4) 水素を含有ガスとして使用する特許請求の範囲第3項及び第8項の非晶質シリコン薄膜トランジスタの製造法。

(5) 前記において、非晶質シリコンを主体とするpn接合を形成する際に、pn接合を2つの工程に分割され第1のpn接合と第2のpn接合とで形成する方法において、第1のpn接合上にソース電極を、第2のpn接合上にドレイン電極を形成するが、前記第1のpn接合と第2のpn接合とが分割された部分に電気的な絶縁物を形成するか、基板部分上にゲート電極を形成するかを特徴とする非晶質シリコン薄膜トランジスタの製造法。

(6) 半導体層を形成した後、基板を大気にふれさせることなく引続いてpn接合を形成する特許請求の範囲第10項の非晶質シリコン薄膜トランジスタの製造法。

(7) 半導体層が、シリコンと水素との化合物又は／及びシリコンと窒素との化合物のグロー放電による分解について形成される特許請求の範囲第10項の非晶質シリコン薄膜トランジスタの製造法。

(8) グロー放電を利用した装置で半導体層とpn接合を連続的に形成する特許請求の範囲第12項の非晶質シリコン薄膜トランジスタの製造法。

(9) グロー放電装置を一定にする特許請求の範囲第12項の非晶質シリコン薄膜トランジスタの製造法。

3. 発明の詳細な説明

本発明は、非晶質シリコンを用いた薄膜トランジスタ及びその製造法に関する。

従来、水素化非晶質シリコン (a-Si:H) を用いた薄膜トランジスタ (TFT) が提案され予備的用の

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トランジスタとして使用されるのが、D. LeComber らによって初めて示された (Electronic Letters 15, 179 — 181 (1979))。

その特長は、基板上に、ゲート電極、絶縁ゲート電極を介して設けられた水素化シリコンから成る真性および導電上にa-Si:Hから成るソース電極及びドレイン電極とを設けたものである。

この様な構造のa-Si:H-TFTはゲート電極に一定電圧 (V_G) を印加し、ソース電極とドレイン電極間の電圧 (V_D) を変化させた時のソース電極とドレイン電極間を流れる電流 (I_D) は、V_Gが十分大きい領域で飽和傾向を示す。即ちある領域を示さない。また、前述V_G-I_D特性がV_Gの小さい領域において電流的にならずにV_G-I_D特性曲線が立ち上がりのよい良好なトランジスタ特性を示さない。これらは、a-Si:Hから成る半導体層とその上のオーミックな接触が形成されていないために起こっている。

本発明は、かかる点に鑑み成されたものであって、V_G-I_D特性曲線に折れのない好ましいトランジスタ特性を示す非晶質シリコン (a-Si) TFTの提供及びその製造法を提供することを目的とする。

本発明のa-Si-TFTは、水素化又は／及び水素化の非晶質シリコンから成る半導体層、絶縁上に互いな絶縁物を介して設けたゲート電極、前記半導体層のウィンドウエリアに互いに絶縁されて設けられた、ほう素シリコンを主体とするn1のpn接合及びn2のpn、n1のpn上に形成されたソース電極、n2のpn上に形成されたドレイン電極とで形成されていることを特徴とする。

又、本発明の製造法は、前記に記載する構成において、ゲート電極と互いな絶縁物とが形成されてある非晶質シリコン薄膜トランジスタ形成用の基板上で、且つ前記絶縁上に真空槽を介在の入替えによって水素化又は／及び水素化非晶質シリコンから成る半導体層を形成した後、引続き、ある導電シリコンを主体とするpn接合を形成するが、このpn接合を二つの工程に分割されたn1のpn接合とn2のpn接合とに形成するが、その後、前記ゲ

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1のゲ[illegible]にソース電極を形成及び第2のゲ[illegible]上にドレイン電極を形成するステップを特徴とする。又、更には、本発明の製造法としての特徴は、基板にしみる程度に塗布された非晶質シリコン膜とリンリユッタ膜材のみを上記の目的に応じて、ホウ化又は／及び非晶質非晶質シリコンから成るやはりを形成した後、引続いて、非晶質シリコンを形成するガスとその他やはり上に形成するガスがゲ[illegible]を2つの互いに絶縁された第1のゲ[illegible]と第2のゲ[illegible]とに分割するが、第1のゲ[illegible]上にソース電極を、第2のゲ[illegible]上にドレイン電極を形成するが、前記第1のゲ[illegible]と第2のゲ[illegible]とが絶縁された後に電気的な絶縁膜を形成するが、基板材上にゲート電極を形成するが、を特徴とするものである。

以下、本発明を図面に従って具体的に説明する。

第1図は、本発明の非晶質シリコン膜トランジスタの1例を示す電気的な断面図を示している。第1図に示されるp-Si-TFT[illegible]は、ガラス、セラミックスなどから成る基板104上に、ゲート電極101、

ゲート電極101を覆うように電気的な絶縁膜104及び水素化又は／及び非水素化非晶質シリコンから成る半導体膜105を形成形成されている。半導体膜105の膜108上には電極領域ではおよそ1の[illegible]107-1、第2の[illegible]107-2が設けられ、第1の[illegible]107-1上にはソース電極102、第2の[illegible]107-2上にはドレイン電極103がもうけられた構造をもした構成とされてある。

本発明において、半導体膜105上の領域（チャンネルエリア）106に接してもうけられる第1の[illegible]107-1及び第2の[illegible]107-2は、半導体膜105を形成した後、絶縁膜108を大気又は真空に触すことなく形成されるものである。

この為に、半導体膜105の膜厚108が絶縁性能のチャンネル形成の中に、[illegible]を形成することによって半導体膜105と[illegible]107との界面において、良好なヴェック特性が形成され、ヴゲ-id特性曲線に歪みのない優れたトランジスタ特性をホモp-Si-TFTが与えられる。

本発明において、ゲート電極101、ソース電極

102及びドレイン電極103のそれぞれを形成する材料としては、Al, Mo又はこれらの合金Mo-Ta, Mo-Wなどが有効なものとして使用され得、それらの材料としては厚さ0.01～0.02μmとされ、真空蒸着等の通常の気相成長法によって形成される。

また例えば絶縁膜104は、スパッタ法によるSiO2膜、グロー放電分解法による窒化シリコン膜などで形成され、この外、Al2O3なども有効な材料として使用される。

半導体膜105及び[illegible]107は、ヒドロ／及びフルオロシリンダロンド（平均的な[illegible]）が絶縁された非晶質シリコンを材料として形成される。

上記の絶縁された非晶質シリコンの形成には、水素又は／及び非水とシリコンとの化合物を使用し低温グロー放電分解法に従って行われる。

本発明において、使用される水素又は／及び非水とシリコンとの化合物としては、シラン、ジシラン、四フッ化シラン、四塩化シラン等、その中で例えば、SiH4, Si2H6, SiF4, などが

に有効なものとして挙げる事が出来る。

これらの化合物は、半導体膜及び[illegible]を形成するに際してガスを供給ガスとして希望の時間をでガス状態で成膜し得る適当容器に所定の圧力の下に導入される。

[illegible]を形成するには、上記の化合物の他にドーパントの導入用の化合物として、ボと水素との化合物又は燐と水素との化合物を適当容器内に具備させてグロー放電を生じて[illegible]を形成する。この形成されるには、ドーパント導入用化合物の適当容器内への導入は真空排気に従ってドーパントとしての硼又は／及び燐ガスが導入され、[illegible]状態の半導体が形成される。

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本発明において、本発明に使用される第1族元素と水素との化合物としては、具体的には例えば PH_3 が、炭素と水素との化合物としては Si_2H_6 を挙げることが出来る。この他、容易にガス化し得る化合物であれば、炭素数の大きいものも使用し得るものである。

本発明において、その目的を効果的に達成するためには、α° 及び β° を形成する際に、膜に形成されてあるのは第 IB 族の元素を例えば電離室内のエッチングをして次工程で行なうことはせず、成膜後の状態の膜面に α° 及び β° を形成する必要がある。

更には α° 及び β° の形成に際し、母体ガスとしてのシリコンと水素又は／及び水素との化合物とドーパント導入用のガスとしてのドーパントガスであるシリコンと第 IB 族の化合物又は／及びシリコンと水素との化合物の成膜空間への導入の割合を正確に制御する必要がある。本発明におけるその割合は、シリコンと水素の化合物を母体ガスとして使用する場合には、母体ガスに対してドーパントガスを通常は 5×10^{-5} ～ 5×10^{-2} atom、好適には 10^{-4} ～ 10^{-2} atom とされるのが望ましいものである。また水素とシリコンの化合物からなる母体ガスに対して、通常は 2 : 1～50 : 1、好適には 5 : 1～20 : 1 とされるのが望ましいものである。

本発明においては、形成ガスとしては、通常 H_2 ガスが好ましいものとしてあげることが出来る。また、水素とシリコンとの化合物を使用する場合には、H_2 ガスを形成ガスとして使用する方が良い結果を得ることが出来る。

上記の条件組合せの他、形成される第 IB 族原子 IB の特に α° 及び β° 量を調整する為としては、特に基板温度、形成雰囲気の圧力、及びグロー放電電力をあげることが出来る。

これ等の因子は、本発明においては、その目的をより効果的に達成するために、次の様な範囲内に制御されて、形成が成される。

水素化非晶質シリコン（a-Si:H）の場合には基板温度として通常は 100℃ ～ 300℃、全圧力としては通常 0.10 ～ 1.0 Torr、放電電力としては通常 0.005 ～ 0.1 W/cm² とされるのが望ましいものである。シリコンと水素との化合物を母体ガスとして使用する場合には、母体ガスに対してドーパントガスは通常 10^{-5} ～ 5×10^{-2} atom、好ましくは 5×10^{-5} ～ 10^{-2} atom の割合で混合されるのが望ましいものである。

この様な混合割合に於いて、混合後のガスをグロー放電を生起させる堆積空間に導入して共存させることで形成された堆積膜中でグロー放電を生起させ、該グロー放電を利用して前記の母体中の IB 族の原子 IB 上に第1の α° 及び β°-1 と第2の α° 及び β°-2 とを積層させて本発明の目的を達成することにより、良好なトランジスタ特性を示す非晶質シリコン TFT を得ることが出来る。

本発明の第 IB 族を形成する際の母体ガスとしての水素又は／及び水素とシリコンの化合物はそれ等だけで堆積空間に導入させてもよいが、好ましくは He ガス又は／及び Ar ガスによって稀釈されて堆積空間に導入させられる。この際の稀釈ガスとしての割合は、水素とシリコンの化合物からなる母体ガスに対して、通常は 99.9 : 1～1 : 9、好適には 99 : 1～7 : 3 とされるのが望ましいものである。また水素とシリコンの化合物からなる母体ガスに対して、通常は 2 : 1～50 : 1、好適には 5 : 1～20 : 1 とされるのが望ましいものである。

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上記の条件組合せの他、形成される第 IB 族原子 IB の特に α° 及び β° 量を調整する為としては、特に基板温度、形成雰囲気の圧力、及びグロー放電電力をあげることが出来る。

これ等の因子は、本発明においては、その目的をより効果的に達成するために、次の様な範囲内に制御されて、形成が成される。

水素化非晶質シリコン（a-Si:H）の場合には基板温度として通常は 100℃ ～ 300℃、全圧力としては通常 0.10 ～ 1.0 Torr、放電電力としては通常 0.005 ～ 0.1 W/cm² とされるのが望ましい。

弗素化非晶質シリコン（a-Si:F）、及び水素弗素化非晶質シリコン（a-Si:F,H）では基板温度は通常 200℃ ～ 500℃、全圧力は通常 0.10～1.0Torr、放電電力は通常 0.1 ～ 1 W/cm² とされるのが望ましい。

本発明においては、形成される α° 及び β° 量の比較値はより効果的には本発明の目的を達成するために 10^3 Ω-cm 以下にされるのが望ましいものである。この様に α° 及び β° 量の比較値を 10^3 Ω-cm 以下とするには、前記の形成条件の他に基板温度、全ガス圧力、グロー放電電力の条件を相互に設定して行なう必要がある。その様な条件は、シリコンと水素の化合物を母体ガスに使用する場合には基板温度としては、通常 100℃ ～ 300℃、全圧力としては通常 0.10 ～ 1.0 Torr、放電電力としては通常 0.01 ～ 0.1 W/cm² の範囲を得ましいものとしてあげることが出来る。

母体ガスとして、シリコンと水素との化合物を使用する場合には、基板温度としては、通常 200℃～

500℃．全ガス圧力としては通常0.1Torr～1.0Torr，好ましくは0.1～1 Torrの範囲内で供給する必要がある。

α°Siを形成する際に，原料ガスとしてのシリコンと水素との化合物又は／及びシリコンとハロゲンとの化合物と，ドーパントガスとしてのシリコンと燐との化合物又は／及びシリコンと燐との化合物の他に望ましくは稀釈ガスとしてH2，He，Ne等のガスを用いて所定の割合に稀釈するのが好ましいものである。殊にH2ガスの使用は良好な膜質を得ることが出来，好ましいものである。

この際，稀釈ガスの混合割合は，水素とシリコンの化合物からなる原料ガスに対しては稀釈ガスとの混合ガスの割合との比で，通常は99.9：1～1：9，好ましくは99：1～7：3とされるのが望ましいものである。

また水素とシリコンの化合物からなる原料ガスに対しては，稀釈ガス単独の混合ガスの割合との比で2：1～50：1，好ましくは5：1～20：1とされるのが望ましいものである。

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成する場合，各電極，α°Si，中間層，及び絶縁の作成条件は前記したスタガード型の構造のTFTの場合と実質的には同じであって，ただ，それ等の作成順が異なるだけである。

コプレーナー型TFTを作成する場合には，先ず，所定通りの洗浄基板を用意した基板を用意し，該基板を所定内の反応室に設置して，グロー放電によって中間層を形成する。中間層の形成後，引続き該反応内の真空を破ることなく，グロー放電を続行しながら原料ガスを変えてα°Siを前記中間層上に形成する。α°Siの形成後，該α°Siを所定のパターニング及びエッチングの処理によって一部分を除去しが2つの離隔された部分に分離し，第1のα°Si及び第2のα°Siを中間層の表面上に互いに対向して形成する。

その後，グロー放電法，スパッタリング法若しくは真空蒸着法によって前記α°Siの除去された部分に絶縁層を設ける。

次いで，第1のα°Si上にはソース電極を，第2のα°Si上にはドレイン電極を，絶縁層上にはゲート電極を形成する。

上記において，絶縁層と各電極の形成順は逆にしてもよいもので，組合せに応じて種々の組み合せで，それ等は形成されてもよいものである。

実施例1

第1図に示す形態で，以下のA～Dの4種類の試料を作成して，各々のトランジスタ特性を測定した。

(試料A)

第1図の構造において，α°Si 107のないもの

(試料B)

第1図の構造において，中間層105を形成した後，該層105の表面を大気に触し，その後，その表面上に直接α°Si 107を形成したもの

(試料C)

第1図の構造において，中間層105を形成した後，該層105の表面を大気に触さないが，グロー放電チャンバーを変え，その後，前記層上に直接α°Si 107を形成したもの

(試料D)

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第1図の装置において、グロー放電を生ずることなく(例えば一定の放電電圧を維持した状態で)ゲート弁105と10'弁107とを連続的に制御したもの

(その他の実施の仕方及び作用効果)

基板104は厚さ1.2mm、大きさ70×70mmのコーニング社製#7059ガラスを用いた。該ガラス基板は中性洗剤を用い超音波洗浄を5分行ない、次いで蒸留水、イソプロピルアルコール蒸気により充分洗浄したのち乾燥し、次に真空槽内に設けてある加熱ヒーターにより充分乾燥し、ひきつづきイソプロピルアルコールで超音波洗浄を3分行ない蒸留水煮沸洗浄で洗浄させて基板を表面処理した。このように表面処理したガラス基板104上にアルミニウムを圧力1.5×10⁻⁵ Torrの下で真空蒸着しガラス基板104上に一旦に1500Å付着させたのち、厚さ200Å、幅2mmのゲート電極を形成させるための電極のパターニング、エッチングをAZ1350H(Shipley社製)のフォトレジストを用い通常の方法で行なった。

パターニングされたアルミニウムゲート電極上に第2図に示される組成を用いて下の様にして絶縁層104としての窒化シリコン膜を形成した。

真空槽にゲート電極101の形成されたガラス基板104を置き0.5mm、大きさ2.0cmの厚さのSUS 304製の基板ホルダに固定して、電極面201内に配置されてある、加熱線及び上下自由に可動する大きさ20mmφのSUS 304製のアノード電極202の所定位置に基板を固定した。

又、厚さ3mm、大きさ17mmφのSUS 304製のカソード電極203上には、厚さ3mm、大きさ17mmφの前記ガラス基板と同様に窒化処理を施した石英板205を設置した。

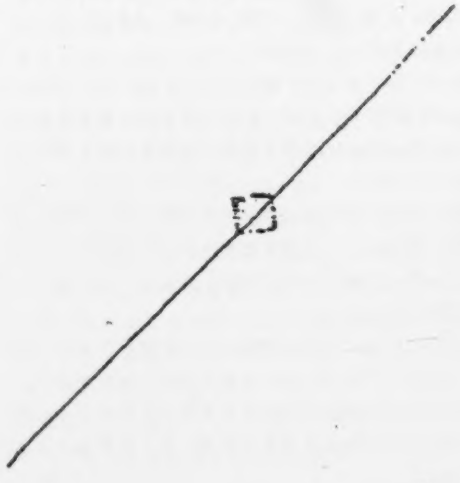
次に、モーター204をON状態にして、ガラス基板を均一に加熱して250～260℃に保持した。電極面201内をB-Aゲージ(ANELVA製)の指示が圧力1.0×10⁻⁶ Paになるまで排気した。

この時、ニードルバルブ209-1～209-6は全て閉

じた状態を維持した。又、ガス供給制御装置(MFC)210-1～110-6としてはサーマルマスフローコントローラ(Tylan Corporation製FC-260)を使用した。

次に、N_2ガスライン211-1のMFC210-1の目盛を100SCCMに設定し、次いではSiH_4ガス(SiH₄濃度10vol%)ライン211-2のMFC210-2の目盛を50SCCMに設定した。その後、ニードルバルブ209-1,209-2を開き、以上2種類の混合ガスを流出させ、管内圧2.5mmで、0.1mmφのガス出口を11個設けた幅21mmφの直状ガス導入管206より前記のガスを供給させ、電極面201内の圧力が低圧真空計(MKSバラトロン型22MA5S)で1Paになるように排気系を調整した。次いで、アノード電極202とカソード電極203間を50mmに保ち、前記のガス導入管206をアース電位に設置するとともにガス導入管206のガス供給口とカソード電極203間を40mmに保ち、アノード電極202とカソード電極203間に高周波電界を印加し電極面201内にプラズマを発生させた。

この時、投入される高周波電圧を0.4kV、高周波電力を5Wにした。この様な条件でプラズマを1時間維持させてゲート電極101を覆うように基板104上に窒化シリコンを堆積させて0.12μ厚の絶縁層104を形成した。



上に供給基板層106上に基層106作成後と同一
[illegible]
反応ガスを用いその後にして膜厚0.2μmのa-Si:H)
を堆積させた中間層層105を形成した。基板層106
形成後ストップバルブ209-1を閉じ次にベースシ
ランガスライン211-2のストップバルブ209-2を開
いた状態でかつMFC210-1の流量を60SCCM
に設定した状態にしてノード電極202とカソード
電極203間に高周波電界を印加し堆積室201内に
プラズマを発生させa-Si:Hを堆積させた。このと
きの投入される高周波電圧は0.4KV.高周波電
力は5Wであった。プラズマは2時間維持させて
0.4μ厚の中間層層105を形成した。
このときの中間層層105の光伝反は2.0×10⁻⁸Ω⁻¹cm⁻¹
であった。
(本試料製作の条件及び作成手順)
(A):上記の様にして中間層層105の形成された基
板104を充分冷却後堆積室201の外に出し、
ソース電極102、ドレイン電極103を中間層層105
表面上に形成するために、ゲート電極101の形成と
同様のパターン105の上にAlを蒸着した。

次いで、ソース電極102とドレイン電極103との
間の距離し(チャネル部分)が50μ、ソース
電極102及びドレイン電極の長さZが10mmに
なる様にパターニングとエッチング処理を施して試
料Aを作成した。
(B):試料Aと同様に、中間層層105までを形成し
た後、一旦真空を破って、基板104を堆積室201
内に設置した後、再び堆積室201の真空度まで排
気した。その後、δ°層107を次の様にして形成し、
次いで試料Aと同様の条件と手順でソース電極102
及びドレイン電極103をδ°層107表面上に形成し
試料Bを作成した。
水素ベースシランガス(SiH₄濃度1mol%)ライン
211-2のMFC210-2の流量を40SCCMに、水素
ベースフォスフィンガス(PH₃濃度100ppm)ラ
イン211-4のMFC210-4の流量を20SCCMに
設定した状態でノード電極202とカソード電極
203間に高周波電界を印加し堆積室201内にプラ
ズマを発生させδ°層107を形成した。
このときの投入される高周波電圧は0.4kV、高周

波電力は5Wでありプラズマは1時間維持させて
0.1μ厚のδ°層107が形成された。
次に試料Aと同様にして、ソース電極102、ドレ
イン電極103とを電極間隔しが50μ、電極の
長さZが10mmになる様にパターニング及びエッ
チング処理を施した。この時Alのエッチング液は
H_3PO_4 : CH_3COOH : HNO_3 : H_2O = 25 : 5 : 1 : 4
からなる混合液で行った。
ドナンネル部分のδ°層のエッチング液はHF : HNO_3
: CH_3COOH = 1 : 20 : 50 からなる混合液にて行
い、20secの処理時間することによりδ°層を完全に
除去した。
(C):試料Aと同様に中間層層105までを形成した
後、一旦グロー放電を終了後の基板温度雰囲気を0に
し(グロー放電を一旦停止し)ストップバルブ
209-2を閉じた。
次に、MFC210-3及び210-4の流量を各々40
SCCM、20SCCMに設定した後、徐々にストッ
プバルブ209-3,209-4を全開して混合ガスを堆
積室201内に放出させ堆積室201内に導入

される高周波電圧を、0.4KV.高周波電力を5W
としてグロー放電を再開させδ°層107を形成した。
この際、プラズマは1時間維持させて0.1μ厚の
δ°層を得た。次に実施例と同様にしてAlを真空蒸
着しパターニング、エッチング処理を施した。Al
のエッチング液は試料A、Bと同一であり、ドナ
ンネル部分のδ°層のエッチング液はHF:HNO_3:
CH_3COOH = 1 : 20 : 50 からなる液で除去した。
ソース・ドレイン間形成し、ソース、ドレイン電
極及びZは試料A、Bと同一である。この様にして
作成した試料を試料Cとした。
(D):試料Cとくらべ、中間層層105形成後基板温
度Tを0とせず、グロー放電が安定した状態で速や
かに、ストップバルブ209-2を開じ、次に予め
MFC210-3,210-4の流量をそれぞれ40SCCM,
20SCCMに設定しておいてストップバルブ209-
3,209-4を開いた。このとき堆積室201内の圧力
は15Paから若干低下したが放電は維持され、約
1分後15Paになった。このときの高周波電力は
中間層層105の形成の場合と同じ5Wであった。

(19)日本国特許庁(JP)

この様な合計でダミー並びを1回繰返すと0.1μmの[illegible]膜107を形成し、その後前記と同様なパターニング、エッチング処理を施し同一形状のソース電極102、ドレイン電極105を形成した。これを試料Uとした。

なお上記合計で形成した[illegible]膜107の比抵抗値は試料B、C、Dともに0.4Ω-cmであった。

第3図にして形成した試料A、B、C、Dに対しゲート、ソース、ドレインのそれぞれに対しリード線とうしのためAlのワイヤーボンディングを施し、第3図に示すごとくソース電極102はエレクトロメーター K(Keithley 社616型)に接続し、ドレイン電極105はソース、ドレイン間に電界を印加するための電圧Vdと、ゲート電極101はゲート電圧に電界を印加するための電圧Vgに接続しVgをパラメーターとし、Vdを変化させてソース・ドレイン間に流れる電流Idをエレクトロメーターにて読みとった。

第4図にVd = 1.5Vのときの試料A、B、C、DのVgに対するIdの変化の様子を示す。

Vg = 1.0 Volt 以下の低電圧領域で特うかなようにゲートリク電流が支配されている為Vgに対しIdが急激に変化しているのは試料Dにおいてみられた。またゲートリク電流はB、C、Dの順に小さくなることもこの図から読み取れる。

ゲート電圧を変えてもVg-Id特性における低い電圧では第4図と同様の傾向を示した。

実施例2

半絶縁性GaAs基板105及びゲート電極107を下記に示す条件で形成し、その後前記実施例1および比較例などは全て実施例1と同一条件で形成して4種類のアクティブ層(試料A-2、B-2、C-2、D-2)を形成しゲートリク電流について検討した。

半絶縁性GaAs基板105はSiドープのGaAsをMBE法(分子線エピタキシー法)で成長させたものを使用した。

GaAs基板105及びゲート電極107を下記に示す条件で形成し、その後前記実施例1および比較例などは全て実施例1と同一条件で形成して4種類のアクティブ層(試料A-2、B-2、C-2、D-2)を形成しゲートリク電流について検討した。

半絶縁性GaAs基板105はSiドープのGaAsをMBE法(分子線エピタキシー法)で成長させたものを使用した。半絶縁性GaAs基板105はSiドープのGaAsをMBE法(分子線エピタキシー法)で成長させたものを使用した。

Vo=1.5 volt)を図5図に示す。なちに明らかなようにσ-イッタ領域は試料0-2で最も広くとれているが他の試料A-2, B-2, C-2 は点状でないことがわかる。

絶縁膜106として窒化シリコンの代わりにSiO_2のスパッタリング膜(膜厚0.1 μ)を用いても同様の結果が得られ、ソース、ドレイン電極とゆるい膜105のガーイッタ領域は中間絶縁膜105とσ膜107の役割を兼用した状態で形成して作成することにより高感度を有するが判明した。

一方絶縁膜ではσ膜形成のためのドーピング材料としてPH_3の例を挙げたがAsH_3を混合したガスを用いてσ層を形成しても良い結果が得られた。

尚、中間絶縁膜のための原料ガスとして上記の実施例ではSiH_4, SiF_4の例を挙げたが他Si_2H_6, SiF_4の混合ガスを用いてもよいことは当然である。

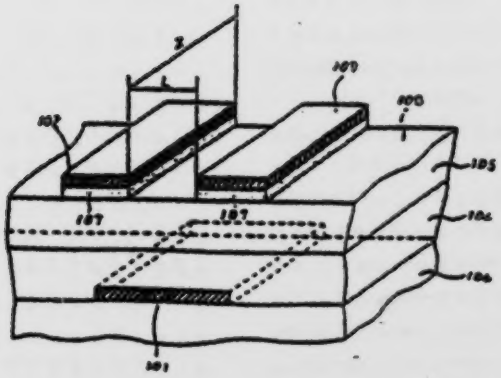
4.図面の簡単な説明

第1図は本発明の好適な実施態様の1つであるトランジスタの構造を説明するための模式的な斜視図である。第2図(a)～(d)は本発明のトランジスタの製造を説明するための模式的断面図。第3図は本発明のトランジスタの特性を測定するための回路図。第4図及び第5図は各々本発明の実施例における効果を示すVo－Io曲線の説明図である。

101 …… ゲート電極　102 …… ソース電極
103 …… ドレイン電極　104 …… 基板
105 …… ゆるい絶縁膜　106 …… 絶縁膜
107 …… σ膜　108 …… クリーンサーフェス

出願人　キヤノン株式会社
代理人　(8807)弁理士　丸島儀一

第1図



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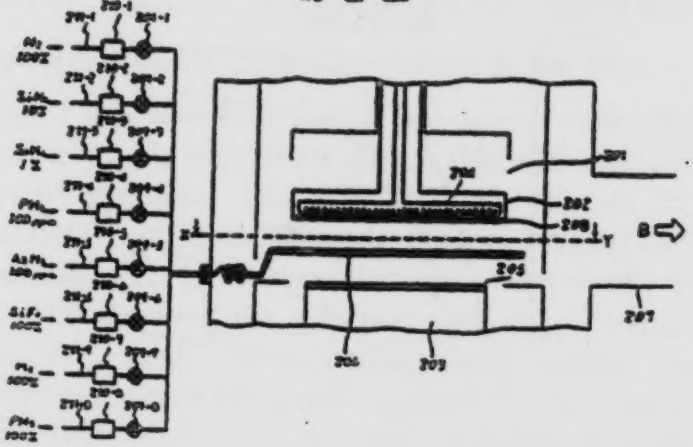
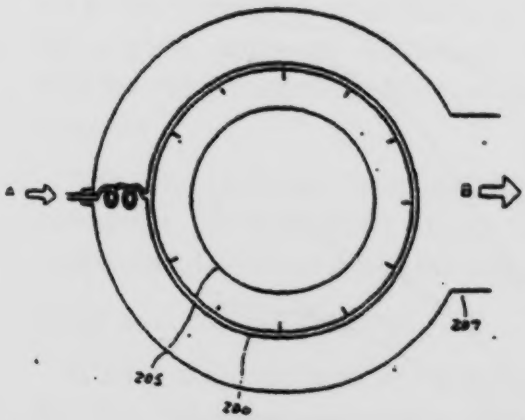
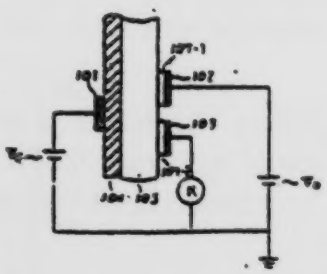
第2図(a)



第2図(b)

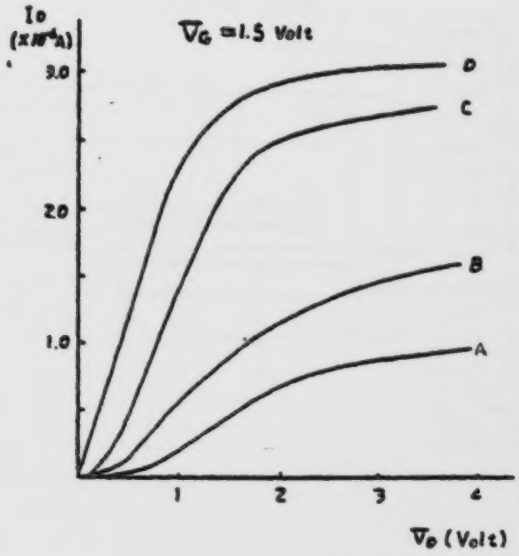


第3図

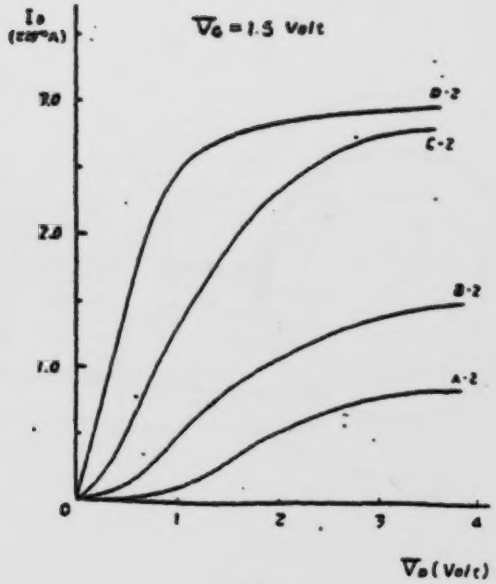


56-135968(11)

第4図



第5図



APPENDIX T

(PRE-EXISTING PARTIAL TRANSLATION OF CANON '968)

PARTIAL TRANSLATION OF JP LAID-OPEN 56-135968

(page 309, column 7, line 17—column 8, line 8)

Fig. 1 is a schematic partial perspective view showing the structure of the amorphous silicon thin film transistor of the present invention. The a-Si-TFT 100 shown in Fig. 1 comprises a substrate 106 made of glass, ceramics or the like, a gate electrode 101 formed thereon, an electrically insulating layer 105 covering the gate electrode 101, a semiconductor layer 105 made of a hydrogenated and/or fluorinated amorphous silicon laminated sequentially, first and second n^+ layers 107-1 and 107-2 arranged in a parallel relation with and separated from each other on the surface 108 of the semiconductor layer 105, a source electrode 102 formed on the first n^+ layer 107-1, and a drain electrode 103 formed on the second n^+ layer 107-2.

(page 309, column 9, lines 6-12)

The electrical insulating layer 104 is constituted with a SiO_2 film formed by sputtering, or silicon nitride film formed by a glow discharge deposition method, or the like, and besides these materials, Al_2O_3 or the like is also an effective material.

The semiconductor layer 105 and the n^+ layers 107 mainly comprises an amorphous silicon in which dangling bonds (unsaturated electron pairs) are compensated by H or/and F.

(page 312, column 20, lines 3-5)

A silicon nitride layer is formed as the insulating layer 104 on the patterned aluminum gate electrode by using an apparatus shown in Fig. 2 in the following manner.

(page 315, column 31, lines 5-10)

The same tendency was confirmed even if a sputtering film (0.1 μm film thickness) of SiO_2 was used in place of silicon nitride, and it was confirmed that the ohmic contact between the source, drain electrodes and the semiconductor layer 105 can be realized by sequentially depositing the semiconductor layer 105 and the n^+ layers 107 with the condition in which the discharge is maintained.

APPENDIX U

(Claim, 1, '636 Patent)

1. An insulated-gate field effect transitor comprising:

a. non-single crystalline semiconductor layer doped with hydrogen or halogen and having an intrinsic conductivity type, said semiconductor layer being disposed over a substrate;

a channel region formed in said semicoductor layer, wherein a concentration of at least one of oxygen, carbon and nitrogen contained in said semiconductor layer is not higher than $5x10^{18}$ atoms/cm^3;

source and drain regions forming respective junctions with said channel region whereby charge carriers move through said channel region between said source and drain regions in a path substantially parallel to said substrate;

a gate insulator comprising silicon nitride and directly contacting said channel region; and

a gate electrode contacting said gate insulator;

wherein said channel region is interposed between the gate insulator and another insulator.

APPENDIX W

(Testimony of Shumpei Yamazaki re Canon '968)

UNITED STATES DISTRICT COURT
E. D. VIRGINIA

C.A. NO. 96 1460-A

SEMICONDUCTOR ENERGY LABORATORY CO. LTD.,
Plaintiff,

v.

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,
AND SAMSUNG SEMICONDUCTOR, INC.,
Defendants.

Testimony of Shumpei Yamazaki, March 17, 1998 re Canon '968

[208] BY ATTORNEY BERG [Attorney for Samsung]:

Q. During the prosecution of the '636 Patent, or the chain that resulted in the '636 Patent, you provided the United States Patent Office with some documents related to the Laid-Open Japanese Application '968, the Canon reference, did you not?

A. Yes, I believe I did, but I would like to confirm this by seeing the patent.

ATTORNEY BERG: Let's show the witness SEL Trial Exhibit 429. That will be Trial Exhibit 1002.
ATTORNEY GOODWIN: The '636 Patent.
ATTORNEY BERG: The '636.

(Plaintiff's Exhibit No. 1002 premarked for identification.)

THE WITNESS: Was there a '968, or such [209] thing as that?

ATTORNEY BERG: I will get back to the '968 now.

ATTORNEY BERG: May we have a copy of SEL 429 for the witness, please?

(Plaintiff's Exhibit No. 429 premarked for identification.)

THE WITNESS: All right.

BY ATTORNEY BERG:

Q. Dr. Yamazaki, this is a copy of what you provided to the Patent Office with respect to Laid-Open Application '968, is it not, sir?

A. Yes, that's correct.

Q. There is a one page partial translation of the Japanese Laid-Open '968, and there is also the entire untranslated document, is there not?

A. Yes, that's correct. It's attached.

ATTORNEY GOODWIN: Excuse me, your Honor. I believe what is marked as SEL 429 includes the entire translation, not just the partial translation.

THE COURT: Can we have a stipulation so that we can get on with it, that the Canon reference, that is Laid-Open Application '968, was made available to the Patent Office in connection with the '636 application, and the English translation was a portion of it, not the whole [210] thing—and the portion of it is reflected, that was translated into English is reflected in what exhibit, Mr. Berg?

ATTORNEY BERG: It's reflected as an attachment to 429. Perhaps we should call that 429A.

THE COURT: All right, in 429A.

(Plaintiff's Exhibit No. 429A premarked for identification.)

THE COURT: Is that stipulated?

ATTORNEY GOODWIN: That's fine.

THE COURT: Let me repeat that stipulation for translation for Dr. Yamazaki.

It is stipulated by and between the parties that in connection with the '636 application, Dr, Yamazaki made available to the U.S. Patent and Trademark Office Laid-Open Applicaton '968 from Japan in Japanese, but with an Engish translation of a portion of the Laid-Open '968 Patent, and that portion is reflected in Defendant's Exhibit 4—what is it, Mr. Berg?

ATTORNEY BERG: 429A.

THE COURT: —429A. And let's show that now to Dr. Yamazaki.

Now, given that stipulation, questions will proceed on that basis.

THE WITNESS: That is correct.

[211] THE COURT: Next question.

BY ATTORNEY BERG:

Q. Dr. Yamazaki, would you acknowledge for me that 429A does not disclose, in this partial translation, a channel region sandwiched between an insulated gate and another layer of insulation?

A. That's correct, that is not disclosed.

Q. Which was one of the elements of your Claim Number 1 in the '636, was it not?

A. That is correct.

Q. You never provided to the Patent Office a concise statement related to the relevance of the Laid-Open Japanese '968, did you sir?

A. I think there is a misunderstanding here. I believe that have to do with Dr. Myerson's earlier testimony having to do with sandwich structure.

Is that the extent of your question, having to do with the sandwich structure?

Q. Yes. I believe your testimony was—no, no, strike that.

What I am asking you is if you provided a concise statement of the relevance, not just about the sandwich structure but of the relevance of the '968 to the Patent Office.

A. I really can't reply without looking at the [212] remarks of the '968. However, however, the part that is translated is what I thought to be the most important portion of the '968 patent.

Q. The most important portion?

A. Yes, the part of '968 that I thought most important. Here it is disclosed that the gate insulator is made of silicon nitrate. I thought this was the most important portion, and this translation was submitted to the United States Patent Office.

THE COURT: Let me ask Dr. Yamazaki, why did you translate any of it?

THE WITNESS: At this time, I was involved in a pending patent. As far as the '968 was concerned, it was a pending patent. That was different from this '636 Patent, in that as well, silicon nitride was an important element of the structure, and what had been translated for that patent was provided, as is for this other patent.

THE COURT: My question to you, Dr. Yamazaki, is: Why did you—why didn't you just give the Patent and Trademark Office the Japanese patent, without any translations?

Why did you choose to translate any of it?

THE WITNESS: Elsewhere I had provided what I thought were the more important or most important references, and I thought that was sufficient.

[213] THE COURT: Did you have any information from anyone that the Patent and Trademark Office required translations of foreign language prior art references?

THE WITNESS: I don't recall whether there is a rule of any kind. I voluntarily did the translation, what I thought the most

important portion, so as to assist the examiner in his examination.

THE COURT: You personally made the decision that just a portion of it should be translated: is that right?

THE WITNESS: That's correct.

THE COURT: Go ahead, Mr. Berg.

BY ATTORNEY BERG:

Q. Dr. Yamazaki, you told the Court, in fact, that the untranslated portion of the Canon reference that was merely cumulative, and you told the Court to, quote, that the Nakagawa reference in fact was cumulative of the Canon reference, did you not, sir?

THE INTERPRETER: I don't know how to say "cumulative" in Japanese. Is that a term of art.

ATTORNEY BERG: I don't either.

THE COURT: He is asking you to give him a synonym in English.

THE INTERPRETER: I can ask—

ATTORNEY BERG: I can do better—

[214] THE INTERPRETER: I can ask him—

ATTORNEY BERG: The Canon essentially repeated the essential elements of Nakagawa.

THE INTERPRETER: I'm sorry to trouble you.

ATTORNEY BERG: Okay.

BY ATTORNEY BERG:

Q. Didn't you tell this Court that the untranslated portion of the '968 was merely a repetition of what you would find in the Nakagawa reference?

A. I don't quite understand what you mean, but I did think that the Nakagawa reference '477 was extremely important in connection with the '636.

ATTORNEY BERG: Let's look at Defendant's Exhibit 1427.

(Defendant's Exhibit No. 1427 premarked for identification.)

THE WITNESS: (Complied)

BY ATTORNEY BERG:

Q. While getting that, do you remember making a declaration, Dr. Yamazaki, over your signature on December 1st, 1997, for this Court?

A. Yes.

Q. Now, let's read it into the record, so his Honor—so there will be no mistake what I am talking about, Dr. Yamazaki. At Paragraph 30 of Exhibit 1427—

[215] THE COURT: You have a copy for Mr. Goodwin?
ATTORNEY GOODWIN: Thank you.
THE INTERPRETER: What paragraph?

BY ATTORNEY BERG:

Q. Paragraphs 30 and 31—

ATTORNEY BERG: after that, we are going to go to Exhibit 426, so if you can have that ready.

BY ATTORNEY BERG:

Q. (Reading:)

"During the prosecution of the '636 Patent, Japanese Laid-Open application '968, assigned to Canon, the Canon reference, was submitted by SEL to the Patent Office along with a partial translation that had previously been prepared in connection with another case.

The Canon reference, a full English translation, and the partial translation, are attached as Exhibit R. Samsung

claims that the untranslated portion of the Canon reference further shows a co-planar thin film transistor with a semiconductor layer sandwiched between a gate insulator and another insulator.

31. This is not material, since SEL also provided the examiner with another reference which shows a thin film transistor [216] structure that is the same as the film transistor structure described in the untranslated portion of the Canon reference. This reference to Nakagawa '477 Patent "discloses, including by a drawing on the cover of the patent, a co-planar thin film transistor with a semiconductor layer sandwiched between a gate insulator and another insulator. A copy of the '477 is attached as Exhibit S."

In fact, you, yourself, made a point of pointing out to the U.S. Patent Office that Nakagawa taught a channel region—excuse me—the channel region of Nakagawa was N-type while your channel region was intrinsic, did it not, sir.

A. Is that included in the '636 remarks?

Q. Let me ask you again, Dr. Yamazaki

Did you tell the U.S. Patent Office that the big difference between—strike that.

Did you tell the you States Patent Office that while you had an intrinsic—a channel region in the intrinsic layer, Nakagawa was different because it had a channel region in the N-type layer?

ATTORNEY GOODWIN: Your Honor, it is not clear to me whether counsel is asking the witness to answer based on memory, or he is directing the witness to [217] a particular document.

THE COURT: Overruled. What's not clear to you doesn't matter. It depends on the witness. He may answer if he can.

THE WITNESS: I just don't recall. What I would prefer to do is look at the details, the particulars in order to confirm it.

ATTORNEY BERG: I will do that in just a moment then.

BY ATTORNEY BERG:

Q. Let me ask you this: Is it a fair statement that in Claim 1 of your '636, that you claimed an intrinsic layer, rather than an N layer?

A. That's correct.

* * * *

[223] ATTORNEY BERG: Let me show you something.

BY ATTORNEY BERG:

Q. Have you seen this drawing before, Dr. Yamazaki?

A. I have not.

Q. I am going to represent to you that this is the drawing that Professor Luckovsky, your expert, made of the fabricaton process in the untranslated portion of the Canon reference.

A. All right.

Q. I would like you to look at the very first layer where it says "insulator." Do you see that, sir?

A. Yes.

Q. And then look at the top, where it says, [224] "Insulator layer can be either SI02, silicon nitride"—let us stop there.

Do you see the Canon reference that you didn't have translated provides a drawing of a thin film transistor with a silicon nitride insulator?

A. I see what's written here.

Q. And in addition, that was part of Claim 1 of your '636 Patent, was it not, sir, a gate insulator comprising silicon nitride?

A. That is correct.

Q. In addition, this Canon untranslated portion, untranslated drawing or unprovided drawing from the untranslated portion of the '968, also contains an intrinsic layer. Do you see that, sir?

THE INTERPRETER: I'm sorry, shows a what?

Q. An intrinsic layer.

A. That's correct.

Q. It also shows, does it not, the sandwich configuration that you said was so important to your patent?

A. Now, you are asking about the Luckovsky drawing?

Q. Yes, I am, which I will represent to you comes from the description in the untranslated part of the Canon reference.

[225] A. He may be saying that, but my point of view is somewhat different.

Q. So, you know what the drawings should look like from the untranslated portion?

A. What we are talking about now, I believe, is a reference in the '968 Patent, an indication in the '968 Patent, that is Exhibit 429, page 17, lines, counting from the bottom, lines 5 through 7.

There is an English translation attached. At this point, I can't exactly tell you where the English appears, of that portion appears in English.

Q. Now, you are disagreeing with Professor Luckosky's drawing, your own expert's drawing, isn't it?

A. I think it would be better if I read this text here.

> Afterwards, by means of the glow discharge method, the sputtering method, and by means of the vacuum evaporation method, the above-mentioned N-plus—the portion mentioned above in which the N-plus layer has been removed is obtained.

In other words, when we are talking about the insulation layer, just judging from the text here, it is hard to tell how and where it is to be provided. Therefore, by one interpretation, what Luckovsky has [226] written is correct. However, just on this text alone, I am not sure whether or not you could not arrive at some other understanding.

Q. But Dr. Yamazaki, forgive me, Dr. Yamazaki, let's assume there is some difference of opinion. Isn't that a discussion that you should have been having with the Patent Office, if you thought there was some area of disagreement?

Shouldn't you have had the entire thing—

THE COURT: The question is now compound. One question.

ATTORNEY BERG: Yes.

BY ATTORNEY BERG:

Q. In fact, under your duty of candor—strike that.

Your indecision about what that means has just occurred to you right now, has it not?

A. Whether at this moment, in any case, in connection with this lawsuit having this text point it out to me by the Samsung side, and having looked over it, I now feel that this Luckovsky diagram may be correct. However, there may be others that are also correct. My understanding of this current structure as indicated here would be vague—

Q. Wait, wait—let me stop you, Dr. Yamazaki. Did you say "would be vague"?

[227] ATTORNEY BERG: Mr. Taylor, did you say "would be vague"?

THE INTERPRETER: Yes.

THE WITNESS: If all you have is this text here, then it is vague.

BY ATTORNEY BERG:

Q. Back at the time that the '636 Patent was pending, did you indicate that to the Patent Office, that within the untranslated portion that there was a structure, untranslated, in an untranslated portion, there was revealed a structure that was very similar to the structure of your patent?

Let me just ask that question.

A. Yes, in the Nakagawa, the '477 Patent, there is a diagram indicating that.

THE INTERPRETER: I asked him to repeat the portion.

THE COURT: He may repeat it.

A. There is a drawing showing that in the channel area, there is a gate insulator directly affixed, attached, touching it.

Within the elements of Claim 1 is the notion of directly contacting. There are words saying "a gate insulator comprising silicon nitride and directly contacting said channel region."

[228] THE COURT: What are you reading from?

BY ATTORNEY BERG:

Q. What are you reading from?

A. I read a portion of a claim of '968.

Q. Let me ask you this, Dr. Yamazaki: If Professor Luckovsky is correct, that what he has described is the sandwich style structure with a semiconductor layer sandwiched between an insulating gate layer and another insulator, as is described here, with the silicon nitride gate insulator, with an intrinsic layer, if Dr. Luckovsky is correct, then he has described in this drawing virtually all the elements of your claim in Claim Number 1; that's fair, isn't it?

THE INTERPRETER: I am going to have to break up that question. I can ask it—I can ask the latter part in a single question, and then fill in the specific items, if you don't mind.

THE COURT: No, let's have the court reporter read the question back slowly, and then you can see—you wouldn't be able to in a single question, but I can understand why you might have to have it repeated.

All right, let's have the court reporter repeat the question.

(The reporter read the record as follows:)

"Question: Let me ask you this, Dr. [229] Yamazaki: If Professor Luckovsky is correct, that what he has described is the sandwich style structure with a semiconductor layer sandwiched between an insulating gate layer and another insulator, as is described here, with the "silicon nitride gate insulator, with an intrinsic layer, if Dr. Luckovsky is correct, then he has described in this drawing virtually all the elements of your claim in Claim Number 1; that'a fair, isn't it?"

THE COURT: Now, one more time, Mr. Berg.

BY ATTORNEY BERG:

Q. Dr. Yamazaki, if Dr. Luckovsky's drawing is accurate, in that it describes a sandwich structure, that is, an intrinsic layer—excuse me—that is, an intrinsic layer sandwiched between two insulated regions, it shows a substrate, it shows an N-plus semiconductor, it shows an N-plus semiconductor on the other side, a source a drain, a gate electron, it shows a silicon nitride gate insulation, if Professor Luckovsky is right in his drawing, hasn't he—doesn't this drawing describe the Claim 1 in your Patent Number '636?

THE COURT: Now you can translate that, can't you?

THE INTERPRETER: I will try.

[230] THE WITNESS If you take this Luckovsky drawing to mean the gate insulating layer is directly touching the semiconductor, then the answer would be yes. That is also indicated in a

drawing in the Nakagawa '477. As mentioned before, also, in prior art section of my '636 patent, the word sandwiched is used.

BY ATTORNEY BERG

Q. My question for you, then is: If Luckovsky's drawing is accurate, doesn't it show me features of claim 1 of the '636 patent than the Nakagawa '477?

A. I don't really think it makes much sense to accept that assumption, however. The big difference between the patent and the Nakagawa is that in the '968 Patent there is no particular indication about impurities in the I-layer.

ATTORNEY BERG: Exactly.

Q. And where you learn about—that's the bigger difference between your—strike that.

The bigger difference, you are telling us, between the '968 and Claim 1 of your patent—let us take Claim 1 of '636—is the failure to tell how to reach low levels of impurities; is that a fair statement?

A. Yes. It does not say that that's to be used in the channel layer.

[231] Q. Now, sir

THE COURT: Mr. Berg, before you go on, this document, does the record show what—where it came from and what role it played?

ATTORNEY BERG: Yes, sir. This is the first embodiment There are two embodiments in the Canon '968. They enclose in the '968.

THE COURT: Yes, but whose drawing is this?

ATTORNEY BERG: His expert, Professor Luckovsky.

THE COURT: In other words, rather than use the Japanese patent itself, fully translated, you are using his expert 'a rendition of what it discloses?

ATTORNEY B&W: Yes, sir.

And he is, as I understand it, saying here, he has now read the embodiment, that is not, it's a diagram that is not, displayed in the Canon untranslated portion. It's not shown at all. But if you draw what's described in the untranslated portion, you get this Configuration.

THE COURT: All right, go on.

ATTORNEY BERG: May I confer for just a moment, your Honor?

THE COURT: Yes, you may.

ATTORNEY BERG: I am corrected, your Honor.

There was no drawing of this of this in the '968.

* * * *

Testimony of Shumpei Yamazaki, April 1, 1998 re Canon '968.

[66] BY ATTORNEY GOODWIN

Q. Do you know whether you specifically pointed out and discussed the '968 laid-open application in the IDS, that the examiner could examine it?

A. You mean at some point here in the remarks area?

Q. Why don't you go ahead, if you could find it there.

A. There is a references to the'968 at page SEC277, in the bottom paragraph.

ATTORNEY GOODWIN: Thank you; Dr. Yamazaki. I'll pass the witness.